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A Study of Indicator Minerals for Kimberlite, Base Metals and Gold: Northern Superior Province of Ontario

by

D. Stone

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Abstract

The northern Superior study area represents a geologic transect across three, fault bounded Precambrian terranes at the margin of the Superior Province, 350 km north of Red Lake, Ontario. Two hundred and five samples of beach sand, modern alluvium, till and glaciofluvial and glaciolacustrine deposits were collected concurrent with bedrock mapping in the area from 1995 to 2000. The samples were processed for heavy minerals (density >3.2), which were picked for gold grains and metamorphosed or magmatic massive sulphide indicator minerals (MMSIMs®*) and kimberlite indicator minerals (KIMs). Dense minerals including chromite, clinopyroxene and ilmenite were also isolated from known bedrock sources including komatiite, gabbro dikes and monzodioritic plutons of the sanukitoid suite for comparison with minerals found in surficial materials.

Beach sand is the dominant sampling medium and it was found that gold grains are very rare in beach sand compared to till. This probably occurs because gold grains are small, silt-size particles and have been washed out of the coarse sandy fraction of beach materials by the action of waves. Hence, with the exception of one anomaly discussed in the text, the gold grain data may provide only limited guidance as to the occurrence of anomalous gold in bedrock.

Three principal types of anomalous MMSIMs® were observed including samples with abundant chalcopyrite, low Cr-diopside+Mn-epidote and chalcopyrite+Mn-epidote+Cr-grossular+arsenopyrite+gahnite. The chalcopyrite-only anomalies occur mainly in plutonic areas and appear to have originated from weak disseminations of sulphide in nearby bedrock, based on observations at one sample site. Two samples of beach material in or near the western Stull Lake greenstone belt have anomalous Cr-diopside+Mn-epidote. These samples also have large heavy mineral concentrates indicating that the MMSIM® indicators have been at least partly concentrated in the sampled material by placer effects. None-the-less, the samples are derived from an area where anomalous base metals are detected by soil geochemistry. The combined soil and indicator mineral results suggest that the western Stull Lake area may be mineralized. One sample at Ponask Lake contains a multi-mineral assemblage of indicators (chalcopyrite+Mn-epidote+Cr-grossular+arsenopyrite+gahnite) and represents an attractive site to be examined further for sulphide mineralization.

Clinopyroxene, olivine, Cr-pyrope and eclogitic garnet, ilmenite and chromite are minerals that can originate in kimberlite although in many instances these minerals can be derived from other bedrock sources also. Standard and modified chemical discrimination techniques as well as comparisons with minerals from known kimberlites and known crustal sources are used to segregate various dense minerals according to a possible origin in kimberlite or other sources. The northern Superior area contains anomalous numbers of KIMs in comparison with many other parts of the Superior Province. The KIMs appear to have originated mainly from lherzolitic sources and a lesser component of harzburgite.

Chromite is a reasonably widespread and tough mineral whose shape, roundness and surface markings can be used to assess the amount of wear to which the grain has been subjected. Various stages of grain wear including within kimberlite, subglacial, aqueous and chemical weathering can be distinguished in some instances and used to qualitatively assess the transport history of the grain. In contrast, Cr-pyrope is a brittle mineral that readily breaks into angular fragments whose shape does not accurately portray the amount of wear to which the grain has been subjected.

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*MMSIM is a registered trademark of Overburden Drilling Management Limited, Nepean, Ontario.

Although KIMs are concentrated in beaches at Stull Lake, the grains are moderately worn and probably have been displaced southerly and southwesterly by the movement of separate lobes of ice. In eastern parts of the area, samples with anomalous KIMs show some alignment parallel to west-northwesterly-trending regional faults and terrane boundaries. A paleoarchean terrane at the north margin of the Superior Province may represent a favourable area to be explored for diamond-bearing kimberlites.

A Study of Indicator Minerals for Kimberlite, Base Metals and Gold: Northern Superior Province of Ontario

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Introduction

The northern Superior area is situated approximately 350 km north of Red Lake, Ontario and includes the community of Sachigo Lake near the Ontario-Manitoba border. The study area extends northerly over a distance of 120 km and varies from 160 km wide in the south to 60 km wide in the north. The bedrock geology of this area was mapped sequentially from 1995 to 2000 (e.g. Stone and Hallé 2000) and represents a geologic transect of the northern Superior Province in Ontario. The fieldwork was done collaboratively with mapping by Manitoba Industry Trade and Mines (e.g. Corkery and Skulski 1998) as part of the Western Superior NATMAP initiative (Percival et al. 2000).

During the course of bedrock mapping, 205 samples of beach, till, modern alluvium and glaciolacustrine sediments were collected. The heavy mineral concentrates from these samples were analysed to assess the potential for gold, base metal and kimberlite mineralization. Results of 1995 to 1998 regional sampling were reported by Stone, Morris and Crabtree (1999) and a detailed study of gold grains in till in the area of the Sachigo River mine was reported by Stone, Hallé and Lange (2000). This report presents results of regional sampling in 1999 and 2000 as well as an interpretation of the combined regional data sets from Ontario and adjacent Manitoba (e.g. Fedikow et al. 1998).

Geology

Bedrock geology of the northern Superior area is characterised by 4 west-northwesterly-trending Archean greenstone belts at Sachigo, Stull, Ellard and Yelling lakes (Figure 1). The greenstone belts are composed of primarily mafic metavolcanic rocks that originated as submarine lava flows. All greenstone belts contain a lesser component of intermediate to felsic, commonly fragmental metavolcanic rocks and clastic metasedimentary rocks and are variably metamorphosed from greenschist to amphibolite facies. Mafic intrusive rocks represented by dikes, sills and stocks of diorite, gabbro and rare anorthositic gabbro intrude the supracrustal sequences in greenstone belts.

Komatiitic lava flows are mapped in the Sachigo belt but have not been identified in other greenstone belts. The komatiites contain chromite and are a potential source for chromite in surficial materials. Chemical comparisons between chromite in komatiite and chromite in surficial materials are discussed later in this report. Late Archean, feldspar- and amphibole-phyric lavas of calc-alkaline to alkaline composition and associated coarse clastic metasedimentary rocks occur in the Stull Lake greenstone belt. Alkaline lavas can contain clinopyroxene (Dostal and Mueller 1992). Hence, the alkaline lavas at Stull Lake are a potential source of clinopyroxene in surficial materials although this mineral was not observed in exposed bedrock of the present area.

The greenstone belts are interspersed with broad felsic plutonic domains. Six suites of felsic plutonic rocks including the biotite tonalite, tonalite gneiss, hornblende tonalite to granite, biotite granite, peraluminous (S-type) granite and sanukitoid suites are identified in the plutonic domains (Stone and Hallé 1997). Among these, the sanukitoid suite is of interest to the present study because monzodioritic phases of this suite typically contain diopside, which is chemically compared to diopside grains found in surficial materials.

The northern Superior area is cut by major west-northwest striking faults that appear to have been active in the late Archean. These include the North and South Kenyon faults and the Stull-Wunnummin fault (Osmani and Stott 1988). In outcrop, the faults are represented by mylonite, cataclasite and strongly foliated rock that typically contain assemblages of greenschist facies minerals (chlorite, sericite, albite, epidote and actinolite) and are cut by epidote-filled fractures. Although straight to curvilinear at a regional scale, the faults can be complexly branched and splayed at a local scale. For example, the North and South Kenyon faults are possibly a composite fault zone joined by several splays.

Nd-isotope and geochronologic studies (Skulski et al. 2000) indicate that the fault zones mark the boundaries of three fundamental crustal blocks in the northern Superior area. These include the Munro Lake terrane south of the Stull-Wunnummin fault, the Oxford Lake-Stull Lake terrane between the Stull-Wunnummin and North Kenyon faults and the Northern Superior superterrane north of the North Kenyon fault. The Munro Lake terrane comprises ca. 2.86 Ga volcanic and plutonic sequences that appear to have developed on the margin of the 3.0 Ga North Caribou microcontinent, which lies south of the present area. The Oxford Lake-Stull Lake terrane is a composite of ca. 2.8 Ga basalts and 2.7 Ga supracrustal and plutonic rocks that were thrust onto the margin of the Munro Lake terrrane. The Northern Superior superterrane is likewise a composite of 2.8 to 2.7 Ga plutonic and supracrustal sequences but is distinguished by Nd model ages and zircon inheritance as old as 3.6 Ga. Skulski et al. (2000) interpreted the Northern Superior superterrane as a recycled Paleoarchean crustal fragment that was tectonically amalgamated with the Oxford Lake-Stull Lake terrane at about 2.7 Ga.

Archean rocks are cut by north-northeast- and northwest-trending gabbro dikes tentatively correlated with the 1884 Ma Molson Swarm and 1267 Ma MacKenzie Swarm, respectively (OGS 1991). The compositions of clinopyroxene and ilmenite from these dikes are discussed later in this report in relation to similar minerals in surficial materials. An unexposed oval carbonatite intrusion (Carb Lake Carbonatite Complex; Sage 1987) occurs north of McLeod Lake (*see* Figure 1) and has a K-Ar biotite age of 1826±97 Ma. The carbonatite contains accessory amphibole, mica, pyrochlore and synchysite (a rare-earth-element-bearing carbonate) but there is no evidence that it has contributed to the normal suite of heavy minerals (garnet, olivine, ilmenite, clinopyroxene and chromite) in surficial materials. Archean and Proterozoic rocks are overlain at the north side of the present area by Ordovician limestone of the Hudson Bay Lowlands.

The Sachigo River Mine produced 1635 kg of gold from a narrow, high-grade vein in the eastern Ellard Lake greenstone belt (*see* Figure 1; Stone 2000) from 1938 to 1941 and represents the only past-producing mine in the area. Gold mineralization has been delineated in sheared supracrustal rocks associated with splays of the Stull-Wunnummin fault at Little Stull Lake and Twin Lakes, Manitoba (west of Stull Lake) by extensive drill programs (Richardson et al. 1996). Several gold showings are identified east of Stull Lake (*see* Figure 1) and typically consist of quartz veins containing sulphide minerals associated with splays and sheared margins of the

Stull-Wunnummin fault. Sphalerite, chalcopyrite and galena occur in sheared volcanic rocks at Stull Lake and Ponask Lake.

Quaternary Geology

Limited information on the Quaternary geology of the area is provided by airphoto interpretation and regional-scale mapping of Bennett and Riley (1969), Dredge and Cowan (1989), Barnett (1992) and the present survey. Eastern parts of the area are blanketed by drumlinized till interspersed with west-southwest-trending eskers and lakes and extensive organic deposits in the north. Southward, the till plain is punctuated by the discontinuous Big Beaver House moraine that extends southeastward from Echoing Lake through the area of Bearskin Lake and Asipoquobah Lakes (Figure 2). Glaciolacustrine deposits are widespread in the area of Little Sachigo and Sachigo lakes. The direction of ice-flow interpreted from striae and drumlins is west-southwest.

The Sachigo moraine is a broad (1 to 2 km-wide) somewhat sinuous ridge that extends north through the area (*see* glaciofluvial ice-contact deposits of Figure 2) locally attaining an elevation 60 m above neighbouring lakes. This feature possibly represents an interlobate moraine west of which a lobe of ice advanced southerly at a late stage in the glacial history of the area. West of the Sachigo moraine, bedrock is overlain by thin, locally drumlinized till and organic deposits. Here, striae are oriented southerly although rare outcrops show an earlier generation of west-southwest directed striae.

Methods

MATERIAL SAMPLING

Approximately 10 kg of material was collected from each of the 205 sample sites listed in Table 1. The sampled material represents a variety of geologic media including beach sand, modern alluvium, till, glaciolacustrine and glaciofluvial deposits. Of the various media, beach sand was most commonly sampled because the beach material was easy to collect and provided a large proportion of sand-sized particles for analysis. Sample 00DST108 (*see* Table 1) represents a unique situation where a 100 kg sample was taken from a beach shown by previous sampling to contain anomalous numbers of kimberlite indicator minerals.

Many samples were collected from the margins of lakes. The shorelines of small northern lakes represent areas where surficial material such as till or glaciofluvial deposits are locally eroded and sorted by the force of waves that are developed on the lake and subsequently impact on the shoreline. On a typical shoreline, impacting waves have sufficient energy to dislodge and transport sand and silt into the lake leaving a "lag" of boulders within a zone extending more-or-less from the high water level to the low water level at the shoreline (Figure 3). Sand-size particles tend to be concentrated among boulders at the low water level and extend as a thin wedge lakeward. Silt-size particles tend to be transported to deeper levels of the lake. The concentration of boulders at the shore of small lakes is also affected by the expansion and movement of lake-ice as it warms in late winter and drifts at the time of break-up. The expansion and movement of lake-ice displaces material onto the shore locally forming boulder ridges at the high water mark. Although sand and silt may also be displaced onto the shore by ice, these small particles do not stay on the shoreline but are moved back into the lake by wave action in summer.

Many small northern lakes do not have beaches because there is insufficient sand-size material to form a beach. In rare instances, large beaches composed of sand can be developed where the shorelines of large lakes abut against glaciofluvial deposits such as eskers and outwash plains that contain a high proportion of sand-size particles. A situation intermediate between these extremes occurs locally where narrow, thin and commonly submerged beaches such as in Figure 3 are developed and are suitable for sampling. During low water conditions such as in late summer, sand-beaches can be exposed and sampled at the shoreline but in most instances samples of sand-sized particles are obtained by digging among boulders in water to 0.5 m depth at the shoreline.

A few samples of sandy modern alluvium were collected from sediment traps within streams. The sample sites include sand and gravel bars and areas of rapids where particles of sand are locally concentrated in bedrock depressions and among boulders.

Till represents the second largest sampled medium (43 samples). Till was usually sampled from hand-dug pits (0.3 to 1.0 m depth) excavated into material accumulated in bedrock depressions on outcrops or at the flanks of outcrops and the flanks of drumlins. Till in the northern Superior area is typically tan brown, silty and well compacted becoming reddish and unconsolidated where it is weathered such as where it forms a thin veneer on outcrops. The pebble fraction contains from 30 to 50% limestone clasts and the remainder is a mix of clasts derived from Archean plutonic and supracrustal rocks. At most localities, till is capped by a thin lag of cobbles and organic material.

Glaciolacustrine deposits comprise grey variably massive to laminated silt and clay and were generally avoided for indicator sampling due to the low proportion of contained sand-size particles. Locally, glaciolacustrine sediments were sampled in areas where sandy seams were observed within the strata. The sample sites include eroded banks at the shorelines of lakes and rivers and pits dug to bedrock.

Glaciofluvial deposits such as eskers and to a lesser extent outwash fans developed on eskers were sampled typically in pits dug to depths of 1.0 m. Eskers are the only available source for sampling material in many areas of extensive muskeg. The moraines were avoided as sampling sites due to the poorly constrained origin of the moraine material. Although drumlins may be in part glacial melt-out features, they appear to be composed of till and are considered have developed primarily during glacial advance.

Several types of bedrock material were sampled and crushed to 0.25 to 2.0 mm size for heavy mineral analyses so that comparisons can be made between the mineralogy of the bedrock and that of surficial material. Examples include carbonatite (sample 01DST01, which did not yield heavy minerals comparable to those found in kimberlite), Molson and MacKenzie dikes (samples 01DST02 and 01DST03 as sources of ilmenite and clinopyroxene), komatiite (sample

01DST04: a source of chromite) and sanukitoid plutons (sample 01DST05: a source of clinopyroxene).

HEAVY MINERAL RECOVERY AND ANALYSIS

Sample processing was done by Overburden Drilling Management Ltd. of Nepean, Ontario. Samples were disaggregated and screened after which the –2 mm fraction ("Table Feed" of Table 2) is passed over a shaking table twice to produce a "table concentrate" of heavy minerals ("Concentrate Total" of Table 2). At the tabling stage, a preliminary count of gold grains including size and shape determination was made. The "table concentrate" of samples containing gold identified at the preliminary stage was subsequently panned and examined under a microscope to provide a refined count of gold grains and description of grain shapes (*see* Tables 3 and 4). A concentrate of heavy minerals (HMC) having a specific gravity greater than 3.2 was obtained by gravity settling of the "table concentrate" in methylene iodide. The HMC was washed in oxalic acid and magnetic grains were subsequently removed. The non-magnetic component of the HMC ("Non-Mag" of Table 2) was sieved to 0.25, 0.5 and 1.0 mm fractions, which were further subdivided paramagnetically to provide small batches of grains for picking.

The components of the non-magnetic fraction of the heavy mineral concentrate were examined under a microscope by staff of Overburden Drilling Management Ltd. and indicator grains of metamorphosed or magmatic massive sulphide deposits (MMSIMs®) and kimberlite (KIMs) are counted and placed in capsules (Table 5 and Table 6). Mineral identification was done of the basis of physical characteristics of the mineral grains with resolution of more difficult grains by analysis of the energy spectrum produced by an x-ray spectrometer on a scanning electron microscope. The heavy mineral picking remarks (Table 7) include identification of grains whose composition was verified by the scanning electron microscope.

Subsequent studies of mineral characteristics including the determination of mineral compositions were done at the Geoscience Laboratory of the Ministry of Northern Development and Mines in Sudbury, Ontario. Representative MMSIMs® and KIMs were examined by binocular microscope and the shape characteristics of chromite grains were studied and photographed by scanning electron microscope.

The majority of KIMs and MMSIMs® identified by Overburden Drilling Management Ltd. as well as grains obtained from known occurrences of mafic dikes, sanukitoid plutons and komatiite were mounted in epoxy and polished and analysed by microprobe. Mineral compositions are listed in Table 8. The microprobe calibration routine and operating conditions are summarised in the *Standard Operating Procedures Manual* and the *Methods Manual for the Analysis of Kimberlite Indicator Minerals* of the Geoscience Laboratories, Sudbury, Ontario.

Gold

Gold grain data is divided into two components comprising results of a detailed survey in the area of the Sachigo River mine and results of the regional survey of the entire northern Superior area.

Results of the detailed survey are described by Stone, Hallé and Lange (2000) and are only briefly reviewed here for purposes of comparison with the regional data. A total of 50 samples of till were collected from a 25 km^2 area in vicinity of the Sachigo River Mine (*see* "Detail Area" of Figure 4). These samples yielded up to a maximum of 69 gold grains per 10 kg of material with a median value of 7 grains per sample. Only one sample contained no gold grains. The largest numbers of gold grains appear to be associated with an oval monzodiorite to tonalite pluton near the Sachigo River mine site. The survey failed to detect clear evidence of an anomalous "train" of gold grains dispersed by glaciers down-ice from the narrow, high-grade quartz vein that was the orebody of the Sachigo River mine.

Regional gold-grain data is summarized in Table 3 and Figure 4. Table 3 also includes results of the detailed survey (samples 99DST03 to 99DST31 and 99DST103 to 99DST123). The shapes of gold grains are classified as pristine, modified or reshaped according to DiLabio (1990). Pristine grains are mainly smooth flakes with sharp edges whereas reshaped grains have the form of rounded and infolded nuggets with pitted and striated surfaces. The transition from pristine grains through the intermediate "modified" stage to reshaped grains in till has been interpreted as the result of damage that gold grains incur as they are displaced by ice. The shapes of gold grains in till have been used to infer the distances that the gold grains have been transported from the place in bedrock where they originated (Averill 1988; DiLabio 1990). Pristine gold grains in till have potentially been transported a short distance from their bedrock source whereas reshaped grains have probably been moved a greater distance.

In the regional survey, a total of 152 samples of material comprising mainly beach sand and a lesser component of till, glaciofluvial and glaciolacustrine deposits were collected. Among the regional samples, only five samples contain more than 5 gold grains (the largest number of gold grains/sample is 18) and 102 samples contain no gold grains. The majority of gold grains are classified as modified and reshaped.

The low numbers of gold grains found in the samples collected as part of the regional survey contrasts sharply with the higher numbers of gold grains found in the detailed survey. An explanation for the disparate numbers of gold grains in the two surveys takes account of the size of gold grains in relation to the size of particles in the sampled material in each case. The dimensions of 101 gold grains identified in the regional survey are listed in Table 4 where it can be seen that most are reshaped flakes. The distribution of gold grain sizes (Figure 5) shows that the maximum dimension of most gold grains is in the range of 25 to 100 microns, which is substantially smaller than the 250 to 2000 micron size of particles that are collected in samples of beach sand.

With reference to Figure 3, the majority of regional samples were taken from sandy material in or near the boulder "lag" on the shores of small lakes. In most instances, this sandy material is derived by wave sorting of sand-size particles from silty till that is common in the region. Gold grains in the till are not likely to be concentrated with the sand but have probably moved with the silt fraction to deeper water (*see* Figure 3). Hence, by sampling sand at the shores of small lakes, gold grains have been selectively excluded because they are small and have been washed out of the sampled material. In contrast, till such as was sampled in the detailed area represents a better medium for gold studies because the particles within till have not been sorted and the numbers of gold grains have been neither depleted nor enriched by the action of water.

In view of the above discussion, the distribution map of gold grains (*see* Figure 4) may be of limited value as a guide for gold exploration. Of the five samples outside the detailed area that contain more than 5 grains of gold, four are derived from till. Likewise, till samples south of Stull Lake contain 1 to 5 gold grains. The apparently anomalous numbers of gold grains in these samples probably indicates that the sampled medium (till) contains a higher proportion of silt and silt-size gold grains than other samples (beach, modern alluvium, glaciofluvial and glaciolacustrine material) rather than providing an indication of anomalous gold in nearby bedrock.

Sample 96DST202 from beach sand on a small island in Ponask Lake contains 18 gold grains, of which 6 are reshaped, 6 are modified and 6 are pristine. Possibly, this sample can be considered anomalous in comparison with the majority of other samples and may provide an indication of gold in nearby bedrock.

Metamorphosed or Magmatic Massive Sulphide Indicator Minerals (MMSIMs®)

BACKGROUND

MMSIMs® are a suite of heavy minerals commonly associated with metamorphosed or magmatic base metal deposits and their alteration zones. Averill (2001) noted three main types of base metal deposits including : 1) volcanosedimentary massive sulphide mineralization (volcanogenic, Sedex and Mississippi Valley sub-types); 2) skarn and greisen deposits; and 3) magmatic Ni-Cu sulphide mineralization. Each has a suite of associated indicator minerals summarized in Table 9. Among the types of base metal deposits, volcanogenic massive sulphide mineralization (VMS) and magmatic Ni-Cu sulphide mineralization (associated with either komatiites or mafic-ultramafic intrusions) are the most common varieties in the Superior Province (Fyon et al. 1992).

Archean volcanic-hosted Cu-Zn massive sulphide deposits are underlain by alteration zones produced by reaction of hydrothermal fluids with the volcanic footwall rocks. The alteration zones have the form of narrow pipes immediately underlying the massive sulphide deposits and broad semiconformable alteration zones that occur over a larger area in the footwall. Morton and Franklin (1987) identified Noranda-Type and Mattabi-Type VMS deposits, each of which has a distinct assemblage of minerals associated with alteration pipes and semiconformable alteration zones. The minerals associated with VMS alteration pipes and zones are controlled by the composition of the hostrock, the depth of sea water at which the deposit formed and the temperature of circulating hydrothermal fluids and are representative of mainly greenschist to lower amphibolite facies assemblages (Morton and Franklin 1987; Gibson and Watkinson 1999). With a few exceptions, such as kyanite and phlogopite, the minerals in VMS alteration pipes and zones tend to be fine grained and are characterised by a specific gravity <3.2. Hence, they are not readily detected by a study of heavy mineral concentrates in surficial materials (Averill 2001).

The phase transformations associated with prograde metamorphism to mid and upper amphibolite facies have the effect of changing the mineralogy of VMS alteration zones and producing coarse-grained and dense minerals (*see* column 2, Table 9). This suite of minerals (column 2 of Table 9) can be readily identified in heavy mineral concentrates and part or all of the suite can be used as an exploration guide for metamorphosed VMS deposits (Averill 2001). Although it is rare for all of the minerals of column 2 of Table 9 to be found in a single mineral concentrate, a broad range of mineral species as well as a large number of indicator grains can be taken as a better indication of a VMS alteration zone than a small number of grains from a single mineral species (Bajc and Crabtree 2001a; 2001b).

Some minerals indicative of the alteration zones of VMS deposits are also produced by high-grade metamorphism of supracrustal and plutonic rocks devoid of VMS deposits. These minerals, which are characteristic of amphibolite to granulite facies metamorphism are listed in column 6 of Table 9 and include sillimanite, kyanite, corundum, orthopyroxene, Mg-spinel, sapphirine and staurolite (Stone 1994). Partial suites of these minerals were identified in granulite terranes of the Pikwitonei domain of northern Manitoba (Arima and Barnett 1984; Mezger, Bohlen and Hanson 1990) and the English River Subprovince (Pan, Fleet and Williams 1994). As pointed out by Stone (1994) other high-grade metamorphic domains may occur in the western Superior Province but are currently undetected by bedrock mapping. Known and unknown metamorphic domains may shed dense mineral grains into surficial materials and contribute to the suites of heavy minerals collected by this and similar surveys. In some instances, mineral compositions, such as the amount of Zn in staurolite (Huston and Patterson 1995) can be used to distinguish grains that are associated with mineralization (Zn-rich staurolite) from those that are associated with regional metamorphism (Zn-poor staurolite). In the majority of cases however, it may be impossible to know whether or not the minerals are associated with mineralization. Hence, anomalies comprised solely of heavy minerals listed in column 6 of Table 9 need to be interpreted with caution because they can come from one or both of VMS alteration zones and barren regional metamorphic domains.

Archean and Proterozoic magmatic Ni-Cu mineralization in and at the margins of the Superior Province is hosted by mafic to ultramafic rocks of both intrusive and extrusive origin. The Thompson and Pipe 2 mines are typical of Ni-Cu mineralization within serpentinized peridotite of the Thompson Nickel Belt of Manitoba (Peredery 1982). The Alexo and Langmuir deposits in the Timmins area (Fyon et al. 1992) are examples of mineralization within komatiitic flows. The Thierry deposit at Pickle Lake (Patterson and Watkinson 1984) represents a highly deformed Ni-Cu orebody associated with metagabbro. Experience has shown that a suite of heavy minerals listed in column 3 of Table 9 that including pyroxenes, olivine, spinels, uvarovite, Cr-rutile, chalcopyrite, arsenides and alloys of platinum group elements is associated with Ni-Cu mineralization (Averill 2001). Hence, the occurrence of anomalous numbers of these minerals in heavy mineral concentrates of surficial materials can be used as an exploration guide for magmatic Ni-Cu mineralization.

Certain mineral species indicative of magmatic Ni-Cu mineralization occur also in non-mineralized mafic to ultramafic rocks. Examples include olivine, orthopyroxene, clinopyroxene and chromite (column 7; Table 9). Olivine, chromite and chrome-bearing clinopyroxene occur widely in unaltered komatiite (Arndt, Naldrett and Pyke 1977; Nisbet et al. 1987) and ultramafic intrusive rocks such as in non-mineralized parts of the Sudbury Igneous Complex (e.g. Scribbins, Rae and Naldrett 1984). Anomalies in heavy mineral concentrates comprised solely of mineral species represented by column 7 of Table 9 need to be interpreted with caution because they can have originated from one or both of Ni-Cu mineralization or barren mafic to ultramafic sources.

In certain instances, mineral compositions such as the Zn-content of chromite can be used to distinguish mineralized from non-mineralized environments. With some exceptions, chromite within mineralized komatiites have typically 1.0 to 3.0 wt % ZnO whereas chromite in non-mineralized komatiite has <1.0 wt % ZnO (Groves et al. 1977; Lesher 1989). The ZnO content of chromite is also affected by the temperature of the magma in which the mineral grew and by metamorphism and is discussed further in relation to the chemistry of chromite associated with kimberlite.

Zincian spinel (gahnite) is associated with metamorphosed volcanogenic massive sulphide mineralization and rare metal pegmatite mineralization (Morris et al. 1997; Dunlop 2000; Spry and Scott 1986). These authors produced a ternary (ZnO-MgO-FeO) diagram that is useful for discriminating the source of gahnite grains.

The composition of clinopyroxene grains can be used to provide insight on the possible source rock from which the grains originated. At the mineral picking stage of the present survey, a bright green colour and $Cr_2O_3 > 1.25$ wt % was used to distinguish Cr-diopsides of kimberlitic origin from pale green low Cr-diopside ($Cr_2O_3 < 1.25$ wt %) representative of magmatic Ni-Cu mineralization (Averill 2001) and non-mineralized sources such as gabbro dikes and sanukitoid plutons. Further discrimination between these and other sources is provided by the Al_2O_3-Cr_2O_3-Na_2O systematics of diopside.

METAMORPHOSED MAGMATIC SULPHIDE INDICATOR MINERALS DATA

MMSIM® data for the northern Superior Area is summarized in Table 5 and Figure 6. During the time of this study, some evolution took place in terms of the species of MMSIM® minerals that are identified and the manner in which they are reported. For example, diopsides were not separated into low-Cr and high-Cr varieties prior to 1996 and certain species of garnet such as spessartine and Cr-grossular seem to have been distinguished from other garnets in recent years more than in former years. The overall reporting format of minerals changed after 1999 (*see* Table 5) however column 1 of Table 5 gives a consistent sum of "prime" MMSIM® minerals, which is shown in Figure 6 for the 1995 to 2000 data.

Present in many samples are a suite of minerals including kyanite, sillimanite, Mg-spinel, staurolite, orthopyroxene and crustal garnet and also present locally are trace amounts of corundum and sapphirine. Although the overall abundance of these minerals and their relative proportions vary from place to place, they are none-the-less present in nearly all parts of the study area and may have originated from high-grade metamorphic rocks. Bedrock mapping has not identified high-grade (granulite) metamorphic domains in the present area so that an obvious source for these minerals cannot be isolated. The generally widespread distribution of candidate minerals from a high-grade metamorphic source suggests that the source domain could comprise either a large and distant place of origin (beyond the margins of this study area) or possibly a series of small, scattered internal sources.

The data of Figure 6 illustrates the distribution of "prime" MMSIMs®, which largely excludes minerals of probable origin in unmineralized metamorphic domains. Three principal types of anomalous "prime" MMSIMs® are observed and include samples containing large numbers of chalcopyrite grains, those containing low Cr-diopside and Mn-epidote and a sample with a multi-mineral suite of indicators. These anomalies are discussed further after presentation of the mineral chemistry.

MINERAL CHEMISTRY

Although much can be gained by thorough analysis of MMISMs® , time constraints have restricted the determination of mineral chemistry to gahnite and Cr-diopside. Analyses of these minerals are listed in Table 8 together with analyses of kimberlite indicator minerals.

Gahnite

Gahnite occurs mainly in the Ponask-Stull Lakes area west of the Sachigo Moraine (6 grains) and to a lesser extent at the eastern margin of the area (3 grains). Five gahnite grains were analysed as shown in Table 8 and Figure 7 in terms of MgO-ZnO-FeO systematics. These represent samples collected since 1998 mainly from the eastern part of the area. One grain is an Mg-spinel and the remaining 4 grains are Zn-rich plotting in the field of pegmatitic spinels and in the area of overlap between the fields of pegmatites, aluminous metasediments and metamorphosed massive sulphide mineralization. Gahnite grains that are representative of pegmatites are found in samples 00DST08 and 00DST09 at the east side of the study area. Unfortunately, gahnite grains from the Stull and Ponask Lakes area have not been analysed and their affinity is unknown.

Cr-diopside

Cr-diopside can be an indicator of magmatic Ni-Cu mineralization, kimberlite or unmineralizaed mafic to ultramafic rocks. Historically, the Cr-content of diopside has been used as a distinguishing factor with high Cr (>1.25 % - Averill 2001; >1.45% - Stevens and Dawson 1977) indicating a potentially diamondiferous kimberlitic source. Low-Cr diopside has been picked in the present study as an MMSIM® indicator however the work of Stevens and Dawson and more recent work in Ontario (Sage 1996) shows that low-Cr diopside is also present in kimberlites such as at Kirkland Lake, Ontario. Morris et al. (2000) and Morris et al.(unpublished data) assembled an extensive database of clinopyroxene compositions. The clinopyroxenes are derived from sources that include kimberlitic xenocrysts, mantle nodules, mafic and ultramafic intrusive rocks and alkaline rocks. Preliminary analysis of the database showed that the Al_2O_3-Cr_2O_3-Na_2O systematics of Cr-bearing diopside provides greater discrimination between kimberlitic and non-kimberlitic sources than Cr_2O_3 (Morris et al. 2000) and this method of analysis is adopted with some modification for the present study.

Cr-diopside analyses of Table 8 are plotted on the ternary diagram of Morimoto (1989) in Figure 8a together with clinopyroxene analyses from known crustal sources in the northern Superior area. All grains are Mg-rich and plot in the fields of diopside and augite. A few Na-rich grains are classified as omphacite. Grains from known sources including komatiite, sanukitoid plutons and Molson and MacKenzie gabbro dikes plot in the augite field or Fe-rich part of the diopside field.

Cr-diopside analyses are plotted on the discrimination diagram of Morris et al. (2000 and unpublished data) in Figure 8b where at least two possible clusters of data are apparent. An oval cluster of data (cluster 1) plots more-or-less in the lower centre of the diagram. Within the database of Morris et al.(unpublished data), this field is characteristic of peridotitic pyroxenes although it is partly overlapped by pyroxenes from other sources including harzburgite and lherzolite xenoliths, lamproite and alnoite and syenite. Later, in the discussion of kimberlitic indicators in this report it will be shown that the data of cluster 1 can be subdivided into two groups (open circles and solid circles; Figure 8b) on the basis of absolute values of Na, Al and Cr. Also, a smaller and somewhat linear cluster of Na-rich grains (cluster 2; Figure 8b) overlaps the field of kimberlitic diopsides and is discussed later.

For the purposes of discussion of clinopyroxenes with a possible affinity to sulphide mineralization, the following is restricted to data from known sources and those grains in surficial materials that are shown by open circles in Figure 8b. Grains from known crustal sources, which include intermediate to mafic monzodiorite, diorite, gabbro and pyroxene gabbro are either Cr-depleted and plot at the extreme bottom of Figure 8b or else plot in the Na-poor part of cluster 1. From this it is apparent that the surficial grains plotting within cluster 1 in Figure 8b need not necessarily be derived from an ultramafic source such as peridotite but can have originated from a variety of intermediate to mafic (plagioclase-bearing) sources as well.

Among the grains that plot within cluster 1 of Figure 8b, those with less than about 32 molecular wt% Na_2O can have originated from mafic dikes including the Molson and MacKenzie swarms. Grains from the Na-rich end of cluster 1 of Figure 8b overlap the kimberlitic field. None-the-less, the dense central part of cluster 1 possibly defines a set of data that is not explained by known bedrock sources in the northern Superior area or kimberlites from the database of Morris et al. (unpublished data). In view of the compositional similarity between data of cluster 1; Figure 8b and known peridotite sources, it is possible that some of the clinopyroxene grains within cluster 1; Figure 8b are derived from ultramafic rocks that may be mineralized.

ANOMALIES CHARACTERISTIC OF VOLCANOGENIC MASSIVE SULPHIDE AND NI-CU MINERALIZATION

There are few indications of skarn- or greisen-types of sulphide mineralization in the study area. Although forsteritic olivine has been identified, particularly in sample 00DST108, this mineral has been interpreted as a kimberlite indicator rather than a skarn indicator.

Previously in this report, it was noted that the MMSIM® anomalies in the study area comprise samples with large numbers of chalcopyrite grains, samples with abundant Cr-diopside and Mn-epidote and a multi-mineral (chalcopyrite+Mn-epidote+Cr-grossular+arsenopyrite) suite. Chalcopyrite is an indicator mineral representative of all types of base metal mineralization (*see* Table 9) whereas Cr-diopside is associated with magmatic Ni-Cu type sulphide mineralization and Mn-epidote is an indicator of VMS-type mineralization.

The chalcopyrite anomalies occur in beach sand and one sample of till overlying both plutonic and supracrustal rocks. In one instance (sample 98DST302; *see* Table 5), a possible bedrock source is identified. Disseminated sulphide minerals and a slight rusty colour were observed in tonalite outcropping a few meters from the sample site suggesting that the chalcopyrite grains may have originated locally. Samples 97DST04, 99DST43 and 00DST103 (*see* Table 5) were also taken close to bedrock of plutonic origin and the anomalous numbers of chalcopyrite grains in these samples may have originated locally from weak disseminated sulphide mineralization in the bedrock. In contrast, the chalcopyrite in sample 96DST100 (*see* Table 5) at Ponask Lake is accompanied by Mn-epidote, Cr-grossular, arsenopyrite and a gahnite grain. This suite of minerals is interpreted as an indicator of local VMS mineralization.

Two factors have possibly contributed to the concentration of Cr-diopside and Mn-epidote in the Stull and Pierce lakes area. The Cr-diopside grains of cluster 1 (open circles of Figure 8b) are widely distributed in the northern Superior area and are concentrated with Mn-epidote in samples 97DST05 at Stull Lake and in sample 97DST103 at Pierce Lake (*see* Table 5). On the one hand, the wide distribution of Cr-diopside of cluster 1 suggests that the grains have originated from either a large and distant source or a series of small internal sources such as scattered ultramafic dikes. Samples 97DST05 and 97DST103 were taken from large beaches and the samples have oversized concentrates (*see* Table 2). Hence, the dense minerals could be at least partly concentrated in these samples by placer effects[1] (Komar and Wang 1984) with the result that the anomalies do not necessarily indicate proximity to a potential source of base metal mineralization.

On the other hand, samples 97DST05 and 97DST103 occur down-ice from the Little Stull Lake area of Manitoba where Fedikow et al. (1998) noted anomalous Ni, Cu and other base metals in till and B-horizon soil. The chemical data of Fedikow et al. (1998) combined with the mineralogical data of the present survey add support to the interpretation that samples 97DST05 and 97DST103 are an indication of base metal sulphide mineralization more so than placer concentrations of dense minerals. Further, samples 97DST05 and 97DST103 occur in or near the Stull Lake greenstone belt that is likely to be more prospective for VMS or magmatic Ni-Cu mineralization than plutonic areas where many chalcopyrite anomalies occur. In summary, although dense indicator minerals have been concentrated on beaches to some extent by the action of waves, soil geochemistry and regional geology indicate that the anomalies may be associated with mineralization. The area extending south from Little Stull Lake through Stull Lake and the area of Ponask Lake is considered worthy of exploration for VMS and magmatic Ni-Cu mineralization.

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[1] Placer effects are the mechanical processes that cause dense minerals to be concentrated in a beach or alluvial placer. Broadly, these include: 1) the wearing down and removal of soft or brittle minerals leaving a residuum of resistant and commonly dense minerals and, 2) a complex interplay between the velocity and flow mechanisms of water with the size, shape and density of particles that typically causes larger, less dense minerals to be winnowed away leaving a lag of finer, denser minerals in certain areas of a beach or stream bed.

A final word on VMS potential concerns the low grade of metamorphism at Stull Lake. The Stull Lake greenstone belt is the largest greenstone belt in the area and contains diverse lithology, regional shear zones, alteration zones and at least two significant base metal occurrences (Stone and Hallé 2000). Although the Stull Lake greenstone belt may be considered favourable for VMS deposits from the perspective of bedrock geology, central parts of this belt are metamorphosed only to greenschist facies. This grade of metamorphism may be insufficient to generate a full spectrum of coarse, dense indicator minerals (e.g. column 2 of Table 9) in VMS alteration zones. Hence, the present MMSIM® survey may not provide a complete assessment of VMS potential at Stull Lake. Further work, possibly involving geochemistry of till samples may be useful.

Kimberlite Indicator Minerals (KIMs)

Kimberlite indicator minerals are discussed in terms of their distribution, the grain shapes including roundness and surface textures bearing on the type of wear to which the grains have been subjected and the mineral chemistry. Finally, the preceding information is summarized with reference to constraints on the place of origin of the grains.

Kimberlite indicator mineral counts are listed in Table 6 for the various species of minerals and the size ranges of the particles. Picking remarks for the kimberlite indicators and other heavy minerals are shown in Table 7. There are anomalous numbers of kimberlite indicator minerals in the northern Superior area. For example, excluding the bulk sample 00DST108, there are 245 indicator grains obtained from 151 samples that were processed for KIMs. In comparison, Stone (1994) found 10 KIMs in 135 samples from the Berens River area, about 200 km south of the present area.

The distribution of raw KIM counts as determined by mineral picking and SEM verification is shown for the entire area and a detail area around Stull Lake in Figures 9 and 10, respectively. Figure 10 also includes part of the data of Fedikow et al. (1998) in Manitoba, for comparison.

By focusing on samples with highly anomalous numbers of KIMs (more than 5 per sample), two basic trends can be seen in the data. East of the Sachigo moraine, a series of samples including 00DST07, 99DST04, 98DST102, 00DST206 and 97DST105 define an anomalous trend extending northwesterly from the area of Swan Lake through Ellard to McLeod Lake (*see* Figure 9 and Table 6). West of the Sachigo moraine a series of samples including 96DST103, 97DST103, 95DST208, 99DST48, 00DST108, 95DST121, 00DST16 and a sample of Fedikow et al. (1998) from west of Kistigan Lake define a northerly trend of anomalous KIMs extending from Ponask and Pierce Lakes through Stull Lake and areas north of Stull Lake. A beach developed from a drumlin at the shore of Richardson Arm of Stull Lake was sampled over consecutive seasons (samples 95DST208, 99DST48 and 00DST108; *see* Table 6) and consistently yielded anomalous KIM counts including 245 grains from 100 kg of material in sample 00DST108.

In the majority of cases, the distribution of individual species of KIMs mimics the distribution of all KIMs. This appears to be true for Cr-pyrope, ilmenite and chromite. Eclogitic garnet, forsterite and Cr-diopside are slightly more abundant west of the Sachigo moraine than east of the moraine. Although widespread in all parts of the area, chromite may be somewhat more abundant in the east such as in the area of Swan and Ellard lakes where it is common to find one or two chromite grains in samples that have no other KIMs.

GRAIN SHAPES

Barrett (1980) summarized extensive earlier work and proposed that the shape of a rock particle can be expressed in terms of three independent properties: form or shape, roundness and surface texture. Form includes aspects of elongation or flatness and sphericity of rock particles. A simple classification based on the ratios of the 3 principal axes divides the shapes of clasts into spheres, discs, blades and rollers (see summary in Selley 1988). Roundness is measured as the ratio of the average radius of corners of a grain to the radius of maximum inscribed circle. The roundness of a grain can be expressed qualitatively as ranging from angular and subangular to subrounded and rounded. Surface texture includes aspects of the markings on the grain caused by contact with other rocks.

A principal goal of kimberlite indicator mineral surveys is to determine where the minerals came from. In glaciated terrains, knowledge of the direction in which the indicator minerals have been displaced by ice provides important guidance on where to search for the source of the minerals. This, combined with geophysical surveys to identify anomalies associated with kimberlite pipes and drilling has lead to the discovery of several kimberlite pipes in Ontario (e.g. Brummer, MacFayden and Pegg 1992a, 1992b; McClenaghan 1996).

In complexly glaciated terrain, such as this study area, which has been affected by multiple ice flow directions, it is exceedingly difficult to reconstruct the transport history of indicator minerals. One needs to know not only the directions but also the distances that minerals have been moved by the motion of various lobes of ice in order to provide even vague speculation as to the place from where they came. Further complexities arise in consideration of minerals that occur in glaciofluvial or glaciolacustrine deposits. These minerals may be displaced significant distances within water that flowed from melting glaciers or moved along the shores of glacial lakes. Mineral grains that occur in modern rivers and beaches can be displaced by the movement of water down-river or along the shore of a lake (Sneed and Folk 1958; Fletcher and Loh 1996; Komar 1976) although in the case of small northern lakes, the distance of longshore-displacement may be negligible.

Although knowledge of ice movement directions is paramount to speculating on the place of origin for a mineral grain, some additional albeit vague information on the distance of transport and mechanism of transport can be gained from analysis of the surface characteristics of the grain. Mineral grains that are displaced by the movement of ice and water are likely to be damaged along the way. By careful study of the surface markings we can gain some insight as to how far and by what means the mineral grain has moved (e.g. Krumbein 1941; McCandless 1990).

Mineral grains with an original euhedral form and delicate facets are good because the severity of damage caused by individual markings as well as the cumulative damage due to all of the markings incurred by the grain can be more readily assessed on a euhedral grain than on one of rounded or irregular shape. Further, it is desirable to work with grains that are abundant and widespread and whose shape can be reasonably estimated prior to displacement by ice and water. Among the various kimberlite indicator minerals, olivine and Cr-diopside of kimberlitic origin are too rare in the study area to provide a statistically reliable basis for assessing transport mechanisms and transport distances from shape characteristics of the grains. The analysis of shape characteristics of kimberlite indicator minerals is restricted, out of necessity, to pyrope, ilmenite and chromite in this instance.

The brittleness of mineral grains is an important factor affecting their use in grain shape studies. Brittle minerals tend to readily break apart into angular fragments destroying the transportation record, which is recorded in the shapes and decorated surfaces of the original grains. Several studies (e.g. Averill and McClenaghan 1994; Dredge, Ward and Kerr 1996) indicate that pyrope occurs mainly as angular fragments in the 0.25 to 0.5 mm range in till and glaciofluvial deposits. These observations are generally confirmed by careful picking that produced more than 50 grains of pyrope from the 100 kg sample 00DST108 of the present study. All of the pyrope grains, for which examples are shown in Figures 11b, d and f have fresh angular surfaces and appear to represent fragments of larger grains. Close inspection shows however that a few pyrope grains are partly bounded by rounded, pitted and striated surfaces described below.

The pyrope grain in Figure 11a is highly rounded on one side and is bounded by a fresh fracture on the other side. This grain appears to represent a particle that was originally both round and spherical and was broken diagonally. The rounded surface of the pyrope grain is decorated with curvilinear, circ-like pits and markings. The grain in Figure 11c is also rounded on one side and has been cleaved by a fairly straight fracture on the other side. Although the visible surfaces of this grain are fresh conchoidal breaks, the rounded outline of part of this grain suggests that it may comprise a fragment of a grain that originally had a spherical shape. The pyrope grain in Figure 11e is almost completely bounded by fresh angular fractures except for one surface (shown by arrow) that appears to represent a segment of a curved surface that is fairly smoothly polished and locally pitted and striated. The curved surface may represent a part of the original surface of a spherical grain.

An overwhelming proportion of the pyrope grains in sample 00DST108 is angular. On the one hand, this observation could be interpreted as indicating that the sample was collected close to the bedrock source of the grains because transport over long distances by ice or water would be expected to produce rounded grains. A corollary of this interpretation holds that pyrope should be angular when it is liberated from kimberlite, which is inconsistent with rounded pyrope grains coated with kelophite in weathered kimberlite (Averill and McClenaghan 1994). On the other hand, abundant angular pyrope grains may indicate simply that pyrope is readily broken into smaller pieces as it is transported. The more-or-less continuous production of fresh grains and grain surfaces would effectively erase the transportation record shown by progressive rounding and decorating of the surfaces of the original grain. The observation of a few grains with rounded, pitted and scratched surfaces among the multitude of angular grains alludes to the latter interpretation because it suggests that at least some pyrope grains were spherical early in their evolution, either when they were liberated from the rock or due to part of their displacement on surface by ice and water. In summary, the available evidence suggests that pyrope behaves brittley under the conditions found in glaciated terrain and the shape characteristics of a small number of grains of this mineral may provide only limited information as to proximity to source.

PARTICLE WEAR

Kuenen (1956) defined 7 distinct mechanisms that contribute to the wear of particles in a dynamic aqueous environment including: (1) splitting, the breaking into two or three parts of roughly equal size. (2) Crushing, the pulverizing of particles, producing material of an entirely different size class. (3) Chipping, the loss of small flakes from sharp edges. (4) Cracking (superficially), in which the principal parts remain in contact-for instance the forming of cone-shaped concussion cracks. (5) grinding in the sense of rubbing, usually with fine material as abrasive. (6) chemical attack (weathering and solution). (7) sandblasting effect. These mechanisms of wear are adopted for this study and are considered applicable with some modifications to environments where grain wear can occur such as within a kimberlite diatreme and beneath glaciers.

Kimberlite indicator minerals can experience several types of particle wear at various stages in their evolutionary path including displacement in a kimberlite diatreme, deformation related to weathering of the kimberlite and pre-glacial fluvial or marine activity, glacial advance, glaciofluvial and glaciolacustrine movement and post-glacial displacement in modern rivers and beaches. In places such as the present area where material may have been overriden by lobes of ice that converged from different directions, several of the later stages of deformation can be repeated. Various stages of particle wear are summarized in Table 10 and discussed further below. Wear related to glacial and post-glacial activity is important to the goal of tracking the source of indicator grains.

Particle Wear in Kimberlite

Kimberlite is a highly corrosive medium and the process of kimberlite emplacement is dynamic with the result that crystals including diamond can be plastically deformed, resorbed, coated, etched and fractured while resident in the mantle or during xenolith disaggregation and kimberlite ascent and cooling (Robinson et al. 1989). As a result of resorption, primary diamond octahedra are reduced in size and progressively rounded and decorated with surface pits, ruts and etches (Otter, McCallum and Gurney, 1991: McCallum et al 1991). The amount of resorption has been attributed to the length of time that a diamond has been broken out of a mantle xenolith and exposed to the corrosive kimberlite (Robinson et al 1989) with a longer time of exposure producing greater resorption. The shape of garnet grains can be extensively modified in kimberlite due to development of kelyphite rims (Garvie and Robinson 1984; Dredge, Ward and Kerr 1996) beneath which the garnet grain has a rounded form and pitted surface rather like an orange peel. Ilmenite is also susceptible to resorption, hydration and fracturing and can develop rims of perovskite and leucoxene (Averill and McClenaghan 1994). Although chromite grains from kimberlite also show evidence of rounding due to resorption (Averill and McClenaghan 1994; Fipke, Gurney and Moore 1995), chromite appears to be a resistant mineral and in the case of the present study, chromite grains show reasonably good preservation of their original octahedral form.

Mineral grains liberated from kimberlite tend to be spherical and variably rounded by resorption and development of mineral coatings but can also be extensively fractured (split) yielding an overall asymmetric shape. The cracks are thought to develop due to accumulation of stresses caused by differential contraction between the crystal and supporting medium on cooling (Robinson et al. 1989). In some instances, fracture surfaces developed on mineral grains in kimberlite are weathered or altered (Garvie and Robinson 1984) and can be distinguished from glacial induced fractures that tend to be fresh (Dredge Ward and Kerr 1996).

Pre-Glacial Particle Wear and Weathering

Averill and McClenaghan (1994) noted well-rounded and frosted garnets in mature Cretaceous quartz sands of the Moose River Basin. These grains, which were possibly derived locally from Jurassic alnoites (Reed and Sinclair 1991) or kimberlites have evidently undergone significant wear in an aqueous surface environment probably unrelated to glaciation. Heavy minerals typically occur as thin sheets or laminae on active sand beaches and are moved in response to high shear stresses related to large eddies in the flow of water (Cheel and Middleton 1986). The rounded and non-fractured form of the heavy mineral grains is an indication that wear took place by gentle grinding, cracking and chipping due to contact with other small particles over a long period of time as opposed to splitting and crushing from impact with larger clasts.

Although the disintegration of mineral grains by weathering can occur at any stage in the evolution of a grain, weathering is at least partly time-dependent and hence likely to be significant during the long pre-glacial period. Mosig (1980) noted that olivine and Cr-diopside were susceptible to weathering in an arid Australian environment probably by alteration to soft, fine minerals such as serpentine and chlorite although these minerals may be less susceptible to weathering in a glaciated terrain (Afanasev, Varlamov and Garanin 1984; Averill and McClenaghan 1994). In the present study, a few chromite grains with spherical outline and whose surfaces are rough and marked by deep irregular and linear pits have possibly been weathered by chemical etching of parts of the grain. The delicate surface features caused by partial weathering of grains can be removed by dynamic particle wear and hence, the effects of weathering particularly at an early stage can be readily destroyed.

Particle Wear by Glacial Transport

Debris can be transported on top of a glacier (supraglacial) or within a glacier (englacial). Bolton (1970) defined supraglacial debris as coarse angular clasts that typically have fallen onto a valley glacier from the rock walls at the side of the glacier. In the case of large continental ice sheets that once covered the present area, supraglacial debris may represent a small amount of the material that is moved by a glacier.

Englacial debris can be further subdivided into material that is transported in a zone of traction at the base of the glacier and material that is displaced to higher levels in the glacier. In alpine glaciers, Bolton (1978) observed narrow (10-15 cm thick) basal transport zones that were laden with clasts eroded from underlying bedrock. Particles are transported within the traction zone by a combination of rotation and translation and are subjected to high stresses due to frictional drag on the underlying bedrock and pinching of smaller clasts between larger clasts. Holmes (1960) and Bolton (1978) documented several shape characteristics and surface textures unique to clasts deformed in the traction zone. Boulders of relatively massive rock such as granite become rounded and their surfaces locally show striations gouged by asperities on the underlying bedrock and other clasts. Although overall rounded in shape, the surfaces of boulders in the zone of traction can also show small flat segments worn onto the surface by traction over bedrock during periods at which the clast maintained relatively stable attitudes. Large boulders partly embedded in lodgement till at the base of a glacier can become asymmetrical due to the movement of debris-laden ice over the clast, which produces a smooth polished surface on top whereas the lower part of the boulder remains rough and angular.

Small, round mineral grains are less likely than boulders to show striations, facets and asymmetry because small round grains are more susceptible to rotational strain and no part of them stays continuously in traction with the bedrock or other particles. Conchoidal fractures and irregular angled microtopography are characteristics of sand-sized particles that have been crushed in the zone of traction beneath a glacier (Krinsley and Doornkamp 1973). Chromite grains in till from the present study show fresh conchoidal breaks that appear to have originated by cracking or crushing the grains between larger clasts, chipping of corners and plucking of angular pieces bounded by intersecting cracks. These appear to be the dominant forms of grain wear for small particles in the basal zone of traction of glaciers.

Material can be shifted from the basal zone of traction to higher levels in an ice sheet by a variety of mechanisms principal of which is the displacement of thrust faults (Christianson and Whitaker 1976). Thrust faults within glaciers typically form a series of concave upward ramps linked to the décollement at the base of the glacier and verging toward the front of the glacier. Motion of the thrust faults displaces ice and debris from the base of the glacier forward and upward overriding the material in front. Once material is displaced up into the ice, it is removed from the zone of traction and can be transported large distances without significant wear.

Particle Wear by the Movement of Water

Fairly extensive early experiments and field observations summarized by Krumbein (1941) and Kuenen (1956) documented particle wear related to intensity and duration of transport in an aqueous environment. Particles tend to become smaller, spherical and more rounded typically following exponential relations to the amount and vigour of transport. The size, form, roundness and surface textures of abraded particles was also found to be affected by the initial size and angularity of the particles, the kind of rock, the type and violence of motion and the size and number of associated particles. Kuenen (1956) showed that particle wear on a sandy bottom is much less than on a pebbly stream bed and identified 7 mechanisms of particle wear (listed previously).

The experiments of Kuenen (1956) showed that crushing, chipping and surface cracking were the dominant mechanisms of particle wear on a pebbly bed that approximates natural streams. In this environment, there is sufficient energy for small mineral grains to be crushed and cracked by the impact of larger grains and for sharp corners to be chipped by impact or rolling. In contrast, grinding and minor chipping were seen as the dominant mechanisms of particle wear on a sandy base, which may correspond with natural wear of particles that are rolled back and forth by wave action on a beach. Grinding is a very slow process that induces wear on the surface of sand grains by the abrasive rubbing action of smaller particles such as silt. Krinsley and Doornkamp (1973) noted V-shaped percussion pits and grooves on the surfaces of water-deposited quartz sand grains and concluded that the pits and grooves resulted from impacting of grains. The frosting observed on well-rounded grains in mature sediments is an indication that micro-cracking and related micro-chipping and plucking may also be components of particle wear on a beach composed of more-or-less same size particles.

AN ASSESSMENT OF WEAR ON CHROMITE GRAINS

Chromite was chosen as a kimberlite indicator mineral suitable for study of grain wear because it is reasonably widespread and evenly distributed in the northern Superior area. Chromite also shows good preservation of crystal faces from which the original shape of the grain can be inferred and hence, the cumulative amount of wear can be qualitatively assessed. Further, chromite grains appear to be tough and fracture resistant. Chromite grains show the accumulated effects of various stages of wear on their surfaces whereas grains of brittle minerals such as pyrope tend to break into fragments whose characteristics may misrepresent the history of the grain.

Forty chromite grains from eighteen samples were examined and photographed by scanning electron microscope. Approximately equal numbers of grains are derived from till and modern beaches with a smaller number of grains from modern rivers, lacustrine deposits and material of uncertain origin. The chromite grains can be further subdivided into groups representing samples derived east of the Sachigo moraine and from west of the Sachigo moraine.

Table 11 provides a description of the chromite grains including their shape, roundness and surface markings. Also included in Table 11 is an interpretation of the type of wear and the wear history for each grain with examples shown in Figure 12 and discussed below.

All grains are worn with the effects of the most recent wear tending to obliterate the record of earlier wear although in some instances more than one stage of wear can be recognized. In this context, the degree of wear at the early kimberlite stage is difficult to assess. Circular pits and or ange peel texture locally on grain 00DST201 (Figure 12a) are possibly representative of resorption at the kimberlite stage. Splitting of grains may also have occurred at a kimberlite stage and the general rounding of the chromite octahedra may be at least partly due to resorption.

A few chromite grains such as 00DST07 (1) and 00DST08 (2) (Figure 12b and Figure 12c) are remarkably rounded and pitted indicating extensive wear. Although these grains were obtained from modern beaches, some wear on their surfaces could have taken place at a kimberlitic stage or a pre-glacial stage possibly by prolonged wear on a beach or in a stream. Grain 00DST08 (2) is split by a conchoidal fracture attributable to glacial crushing and it appears as if some of the rounding of the grain occurred prior to splitting and is therefore attributable to either kimberlitic or pre-glacial aqueous wear. The pitted surface of the rounded chromite grain provides evidence of wear by impacting in an aqueous environment and alludes to prolonged pre-glacial wear in water although it is also possible that the pitting developed very late at the beach stage. In summary, chromite grain 00DST08 (2) (*see* Figure 12c) shows several stages of wear including: a) kimberlitic resorption and/or prolonged pre-glacial impacting, grinding and cracking in water; b) sub-glacial crushing; and c) late aqueous wear. Not all chromite grains show evidence of prolonged early wear and this may be evidence of two populations of grains including those that were extensively worn prior to glaciation and those that were not.

Evidence of weathering by chemical attack on chromite grains is limited. Grain 99DST37 (1) (Figure 12d) from an unconsolidated, red weathered till is pitted and rough in outline probably indicating late weathering. Delicate surface features attributable to chemical attack such as pits and skeletal forms are likely to be removed by glacial or aqueous wear. Hence, the record of pre-glacial weathering is likely to be obliterated.

By far the most severe, widespread and easily recognizable form of wear on chromite grains is the conchoidal breaks and rough microtopography of grains attributable to subglacial crushing. In many instances, subglacial wear has reduced chromite grains to angular fragments and the evidence of this wear is best preserved in samples of till from both sides of the Sachigo moraine (e.g. grains 99DST36 (1) and 00DST210 (1) of Figure 12e and Figure 12f). An important distinction can be made between crushed grains from the east and west sides of the Sachigo moraine and is illustrated by the examples above. Chromite grain 99DST36 (1), which is affected by the west-southwesterly ice advance on the east side of the moraine is angular due to sharp broken edges. In contrast, chromite grain 00DST210 (1), which is from till affected by the lobe of ice that pushed southerly west of the moraine, is sub-angular due to chipping, pitting and cracking of the grain edges. Although pitting is normally attributed to vigorous aqueous wear due to impacting of particles, the general blunting of conchoidally fractured edges possibly results from the extra component of deformation related to the southerly ice advance.

Chromite grains in beach samples tend to be more rounded than those in till due to cracking, chipping and minor grinding of crystal edges. Grain 00DST206 (5) (Figure 12g) from a beach samples east of the Sachigo moraine is a subglacially crushed grain comparable to 99DST36 (1) except for more rounded edges. In this instance, blunting of conchoidally broken grain edges may be due to late subglacial rotational wear on the grain or due to rolling and impacting in an aqueous environment subsequent to the crushing stage.

Chromite grains from beaches and rivers west of the Sachigo moraine are slightly more rounded than those from till but also show the strongly chipped edges such as is observed on grains from till (e.g. Figure 12f). For example, chromite grain 00DST108 (2) (Figure 12h) from a beach west of the Sachigo moraine is sub-rounded and shows chipped and pitted grain edges. Chipping of the sharp, conchoidally broken edges of grains seems to be unique to grains west of the Sachigo moraine and is possibly related to the extra component of subglacial deformation in that area. As discussed previously, the area west of the Sachigo moraine was affected by a lobe of ice that moved southerly at a late stage in the glaciation of the area and locally overrode material that had been displaced west-southwesterly by the regional advance. Even though the southerly motion of the western ice lobe may have been part of the same overall glacial advance as took place east of the Sachigo moraine, it none-the-less caused a second deformation event for material incorporated into or under the ice. In effect, chromite grains west of the Sachigo moraine have undergone two deformation events by glaciation. Possibly, sharp edges produced by sub-glacial crushing during the first (west-southwesterly) event have been subsequently blunted due to wear in the second (southerly) event. Grains from west of the moraine tend to be more severely pitted than those on the east and this suggests that more vigorous aqueous impacting of grains has occurred in the west than in the east. Although the cause of this extra component of wear is obscure, it is possible that the impacting took place in a glaciofluvial environment that prevailed between the ice lobes or is in some way unique to melting of the second ice lobe.

In summary, chromite grains west of the Sachigo moraine are more worn and have more stages of wear with the result that their displacement path is likely more complex than is the case for eastern grains. Chromite grains in till east of the Sachigo moraine show fresh conchoidal breaks that allude to displacement largely by the southwesterly ice advance without subsequent motion in an aqueous or glacial environment. There is no reliable method of assessing the distance of transport from the available data on grain shapes. In all cases, the effect of high-level englacial transport is unknown because grains show no record of any displacement that might have occurred at this stage.

MINERAL CHEMISTRY

Microprobe analyses of mineral grains that were picked as representative of the kimberlitic suite are listed in Table 8 and are separated according to mineral species. Also listed are analyses of MMSIM® minerals including gahnite and low-Cr diopside and analyses of minerals from known bedrock sources. These include chromite from komatiite and pyroxene and ilmenite from mafic dikes and sanukitoid intrusions, which are used for chemical comparison with the compositions of minerals found in surficial materials.

The various species of kimberlite indicator minerals are discussed below with reference to a set of discrimination techniques and chemical variation diagrams that are modified from those used previously by the Ontario Geological Survey (e.g. Bajc and Crabtree 2000a, 2000b; Morris et al. 2000).

Chrome Diopside

The composition of 238 Cr-diopside grains from surficial materials and from known bedrock sources in the northern Superior area are shown in Figure 8a and Figure 8b. Previously, it was noted that grains derived from heavy mineral concentrates of surficial materials fall into two clusters (*see* Figure 8b). A small number of Cr-diopside grains are Cr_2O_3-depleted with low Al_2O_3 and plot at the bottom of Figure 8b. Grains of cluster 1 occur widely in the northern Superior area and seem to be derived from a variety of bedrock sources including intermediate to mafic rocks such as gabbro dikes and sanukitoid plutons for which clinopyroxene data is available. Cluster 1 also closely overlaps the field of Cr-diopside from peridotite in the database of Morris et al. (unpublished data). Later, it will be shown that a subset of cluster 1 clinopyroxenes represented by solid circles, share certain geochemical characteristics with cluster 2 clinopyroxenes (*see* Figure 8b) and hence, are likely derived from ultramafic sources over a wide depth range rather than mafic sources at shallow depths.

Cluster 2 of Figure 8b comprises approximately 42 Cr-diopside grains that are Na-rich and overlap the field of kimberlitic affinity. The grains of cluster 2 plot within the Mg-rich augite and diopside fields of Figure 8a and 7 of the Na-rich grains are classified as omphacite. Clinopyroxenes from known sources including komatiite, sanukitoid plutons and dikes of the Molson and MacKenzie swarms are lower in Na and Cr than grains within cluster 2. It can be concluded that cluster 2 grains are not derived from known crustal sources and must therefore reflect a bedrock source that has not been identified by bedrock mapping.

Further discrimination of the data can be done through a series of simple binary plots (Figure 13) where major elements are plotted against CaO. Calcium is chosen as a discriminator because it is highly variable in clinopyroxene and is an important element in exchange and net-transfer reactions involving clinopyroxene. The majority of clinopyroxenes from cluster 1 of Figure 8b are Na-depleted and plot in a band at the bottom of Figure 13a. In contrast, grains from cluster 2 of Figure 8b are displaced to the right and plot within a diagonal band showing strong Na-enrichment at low CaO in Figure 13a. Also plotting within the diagonal band are a few grains from cluster 1 (solid circles).

Grains of cluster 2 and those represented by solid circles from cluster 1 are characterized by increased Na_2O, Al_2O_3, TiO_2 and to some extent Cr_2O_3 with decreasing CaO. SiO_2 FeO and MgO remain constant or either increase or decrease slightly with decreasing CaO. Grains of cluster 1 (open circles) have slightly decreasing Na_2O, increasing MgO and no distinct variation in other elements with decreasing CaO (compare Figures 13a to g).

Diopside grains from surficial materials in cluster 1 (open circles; Figure 8b) have chemical characteristics broadly similar to the intermediate to mafic rocks from known sources in the northern Superior area although the possibility of an ultramafic source cannot be excluded. The known rocks are gabbro, diorite and monzodiorite that contain plagioclase and orthopyroxene (augite in gabbro dikes and enstatite in monzodiorite) and do not contain garnet. It can be speculated that the Ca and Na contents of clinopyroxene from these rocks are controlled by reactions between clinopyroxene and orthopyroxene or plagioclase. In contrast, the grains of cluster 2 and those represented by solid circles of cluster 1 have Cr_2O_3-Al_2O_3-Na_2O systematics similar to known kimberlites and hence are likely derived from crustal and mantle rocks over a broad depth range. The compositions of clinopyroxenes in cluster 2 are possibly controlled by pressure variations and reactions with minerals such as garnet, olivine and orthopyroxene but not plagioclase.

The trend of decreasing MgO with increasing CaO is the most notable feature in open-circle clinopyroxenes of cluster 1 (Figure 13d) and can be explained by the exchange reaction

$$\underset{\text{Cpx}}{CaMgSiO_6} + \underset{\text{Opx}}{Mg_2Si_2O_6} = \underset{\text{Cpx}}{Mg_2Si_2O_6} + \underset{\text{Opx}}{CaMgSi_2O_6} \qquad (1).$$

Reaction (1) has been extensively used as a thermometer (see discussion of Carswell and Gibb 1987) and proceeds from left to right with increasing temperature.

Ca, Na and Al in clinopyroxene can be controlled by reactions involving the breakdown of plagioclase

$$\underset{\text{Anorthite}}{CaAl_2Si_2O_8} = \underset{\text{Ca-tschermak}}{CaAl_2SiO_6} + \underset{\text{Qtz}}{SiO_2} \qquad (2)$$

and

$$\underset{\text{Albite}}{NaAlSi_3O_8} = \underset{\text{Jadeite}}{NaAlSi_2O_6} + \underset{\text{Qtz}}{SiO_2} \qquad (3).$$

Reactions (2) and (3) have been used as barometers (McCarthy and Patino Douce 1998; Hemmingway et al. 1981) and proceed from left to right with increasing pressure. Although Ca increases markedly within open-circle clinopyroxenes of cluster 1, Na and Al do not change appreciably (*see* Figure 13a and Figure 13b) so that pressure-dependent reactions with feldspar do not seem to have played a major role in determining clinopyroxene compositions. The lack of a pressure effect combined with antithetic Ca-Mg variation in open-circle clinopyroxenes of Figures 8 and 13 are best explained by exchange of Ca and Mg between clinopyroxene and orthopyroxene and implies cooling of source rocks at high crustal levels.

In a garnet-lherzolite system, the Ca- and Al-contents of clinopyroxene can be controlled by 3 reactions. These include reaction (1) above involving orthopyroxene and

$$\underset{\text{in Olivine}}{CaMgSiO_4} + \underset{\text{in Cpx}}{Mg_2Si_2O_6} = \underset{\text{in Cpx}}{CaMgSi_2O_6} + \underset{\text{in Olivine}}{Mg_2SiO_4} \qquad (4)$$

involving olivine, and

$$\underset{\text{Diopside}}{CaMgSi_2O_6} + \underset{\text{Ca-Tschermak}}{CaAl_2SiO_6} = 2/3\ \underset{\text{Grossular}}{Ca_3Al_2Si_3O_{12}} + 1/3\ \underset{\text{Pyrope}}{Mg_3Al_2Si_3O_{12}} \qquad (5)$$

involving grossular and pyrope components of garnet.

Because MgO does not vary antithetically with CaO, it can be argued that reaction (1) has not significantly affected the compositions of clinopyroxene grains from cluster 2 (see Figure 13d). Reaction (4) has been calibrated as a barometer (Kohler and Brey 1990; Finnerty 1986) and proceeds from left to right with increasing pressure. The amount of Ca that is liberated from olivine is very small however (<1 wt%) so that reaction (4) is unlikely to affect clinopyroxene compositions where the mineral is abundant.

Reaction (5) proceeds from left to right with increasing pressure and has the effect of producing less aluminous clinopyroxenes by reducing the Ca-Tschermak component (Nimis 1998). Variation in the Al_2O_3 content of clinopyroxenes is evident in Figure 13b and is possibly attributable to reaction (5). Clinopyroxenes of cluster 1 (half-filled squares) plot along a sloped line characterized by moderately increasing Al_2O_3 with decreasing CaO in Figure 13b. A subset of cluster 2 shown by solid circles plots along a line with steeper slope to the right of the cluster 1 data. The clinopyroxenes represented by half-filled squares and solid circles are thought to have originated from ultramafic rocks on the basis of their elevated Na_2O, Al_2O_3 and Cr_2O_3 (*see* Figures 13a to c) however the half-filled squares have distinctly less Al_2O_3 than the solid circles at a given value of CaO. This may be an indication that the clinopyroxenes represented by half-filled squares originated from a garnet-bearing assemblage such as garnet lherzolite and have lost aluminum to garnet through reaction (5). Clinopyroxenes represented by solid circles may have originated from an ultramafic rock such as lherzolite that is devoid of garnet and in which reaction (5) is inoperative.

Partial melting experiments done using piston cylinders in laboratories and summarized by McCarthy and Patino Douce (1998) show that the Na and Al content of clinopyroxene increases systematically with pressure. Monovalent Na^+ can combine with the trivalent ions Al^{3+}, Fe^{3+} and Cr^{3+} and replace Mg^{2+} in the diopside molecule to form $NaAlSi_2O_6$ (jadeite), $NaFe^{3+}Si_2O_6$ (acmite) and kosmochlor (= ureyite $NaCrSi_2O_6$). Cr can also be incorporated in the Tschermak molecule as $CaCrAlSiO_6$ or $CaCr_2SiO_6$ where Cr may occupy tetrahedral positions. Further experiments by Vredevoogd and Forbes (1975) showed that the solubility of kosmochlor in diopside decreases with increasing pressure and is essentially absent at pressures greater than 45 kbar so that at high pressures, Cr is present only in the Tschermak molecule.

Clinopyroxenes represented by half-filled squares show markedly increased Na_2O and Al_2O_3 coupled with decreasing CaO and MgO. Cr_2O_3 also increases to 2-3 wt % but drops to about 1 wt % as CaO decreases below a value of about 20 wt %. This trend is consistent with progressive replacement of the diopside end-member with jadeite, acmite and kosmochlor with increased pressure. The number of atoms of Na is very nearly equal to the combined number of Al, Fe and Cr atoms indicating that Fe and Cr are present as acmite and kosmochlor and that Cr is not substituted in the Tschermak end-member. This implies that the clinopyroxenes equilibrated at pressures less than about 45 kbars (140 km depth). The drop in Cr_2O_3 for values of CaO less than 20 wt % may be the effect of decreasing substitution of kosmochlor in diopside at high pressures.

Clinopyroxenes represented by solid circles show the same overall trend of increased Na_2O, Al_2O_3 and Cr_2O_3 coupled with decreased CaO but the data is much more scattered. The scattered data may be an indication of metasomatic alteration and possible Na-depletion of the clinopyroxene as the number of atoms of Na is consistently less than the combined number of Al and Cr atoms. Alternatively, some Al and Cr may occur in the Tschermak molecule where it is not coupled with Na.

In summary, at least three groups of clinopyroxene grains can be distinguished geochemically. These include a large group of grains with low Na_2O and which are correlated with known crustal sources including intermediate to mafic rocks of the sanukitoid suites and gabbro dikes of the Molson and MacKenzie swarms. Peridotitic rocks that are unrecognized by bedrock mapping may also be represented by this group. The remaining two groups show trends of increasing Na_2O and Al_2O_3 with decreasing CaO that can be attributed to highly variable pressures of equilibration. These groups are possibly representative of clinopyroxene grains that have been brought to surface within kimberlite pipes from variably great depths in the lower crust and mantle. One group of clinopyroxenes with kimberlitic affinity has lower Al_2O_3 than the other. The low-Al_2O_3 clinopyroxenes may have originated from a garnet-lherzolite system in contrast with a lherzolite system for the high-Al_2O_3 clinopyroxenes.

Clinopyroxenes of presumed kimberlitic affinity are identified in Table 8 and their distribution is shown in Figure 14. The kimberlitic clinopyroxenes are widely distributed although well represented in samples that contain anomalous numbers of other types of kimberlite indicators such as in samples 97DST103 and 95DST208.

Finally, the pressure-sensitive substitution of jadeite and kosmochlor molecules into the diopside structure provides insight on the functionality of the diagram of Morris et al. (2000). In a simple system where the amount of acmite substitution is negligible, clinopyroxene will take in more Na, Al and Cr with increasing pressure in the form of jadeite ($NaAlSi_2O_6$) and kosmochlor ($NaCrSi_2O_6$) and the number of atoms of Na will be approximately equal to the combined total of Al + Cr atoms. Hence, when clinopyroxenes that have equilibrated at variable depths are brought to surface in a kimberlite pipe, they will have different absolute contents of Na, Al and Cr but the ratio of Na:Al:Cr will be approximately constant with $Na \approx Al+Cr$. This will cause the clinopyroxenes to plot within a diagonal band approximately 1/3 of the distance from the $Na_2O/62$ apex on the Morris et al. diagram (*see* Figure 8b). Clinopyroxenes with a high jadeite component will plot near the bottom of the band (close to the $Al_2O_3/102$-$Na_2O/62$ join) and those with a high kosmochlor component will plot near the top of the band close to the $Cr_2O_3/152$-$Na_2O/62$ join.

In view of the experimental work of Vredevoogd and Forbes (1975), the Morris et al. diagram would be expected to fail for clinopyroxenes equilibrated at very high pressure (>45 kbars) where Cr is thought to enter the clinopyroxene structure as a Tschermak molecule and the above stoichiometric relations break down. The present work provides an indication that the Morris et al. diagram is useful for garnet-bearing assemblages because grossular is needed to buffer the amount of Al within the Tschermak component of clinopyroxene according to reaction (5). For example, the clinopyroxenes represented by solid circles in Figure 8b are possibly derived from a garnet-absent assemblage and plot outside of the kimberlitic field due to enrichment in Al. Pre-screening of data with simple binary plots such as Figure 13 can help to identify Al-enriched clinopyroxenes.

Olivine

Twelve olivine grains were selected for analysis (*see* Table 8). Two grains come from samples east of the Sachigo moraine whereas the majority of grains are derived from the bulk sample 00DST108 at Stull Lake. The olivine grains are MgO-rich with the component of the forsterite end-member ranging between 85 and 92.

Although forsteritic olivine is a characteristic mineral in kimberlite, it is not unique to kimberlite and can occur in a range of ultramafic supracrustal and plutonic rocks (e.g. Arndt et al. 1977; Scribbins et al. 1984). Hence, it is necessary to consider other chemical parameters in an attempt to distinguish kimberlitic olivines from those of other sources.

Some insight into the conditions of formation of olivine in a garnet peridotite can be gained from CaO-NiO systematics. Simkin and Smith (1970) and Finnerty (1986) showed that the Ca-content of olivine decreases inversely with the pressure at which they grew by reaction (4) cited previously. Accordingly, olivines formed at deep crustal levels ought to have lower Ca than those formed on or near surface. Cooling rates can also affect the amount of an incompatible element such as Ca that is incorporated in olivine. For example, komatiites have high Ca (>0.2 wt %; Nisbet et al. 1987; Cattell and Arndt 1987) whereas olivine in large mafic intrusions such as the Sudbury Igneous Complex have low Ca (>0.08 wt %; M. Moore, unpublished data). Although high-Ca in komatiite and low-Ca in the Sudbury Igneous Complex are consistent with the above pressure relations, the Ca variations may also be attributable to much more rapid growth of olivine in komatiite than in the large intrusion.

Olivine exchanges Ni with chrome-pyrope garnet according to the reaction

$$\underset{\text{Garnet}}{Mg_3Al_2Si_3O_{12}} + \underset{\text{olivine}}{Ni_2SiO_4} = \underset{\text{garnet}}{Ni_2MgAl_2Si_3O_{12}} + \underset{\text{olivine}}{Mg_2SiO_4} \qquad (6).$$

Reaction (6) is temperature dependent with garnet taking in more Ni at high temperatures and has been used as the basis for Ni-in-pyrope thermometers (Griffin et al. 1989; Canil 1994; Ryan and Griffin 1996). Hence, the Ni-content of olivine would be expected to increase with cooling as long as garnet is present although the change would be small because Ni is much more abundant in olivine than in pyrope.

A kimberlite diatreme would be expected to incorporate olivine grains from a range of depths and the CaO-NiO variations in the olivine grains might provide a distinct signature for kimberlitic olivines. The CaO component of olivine that is controlled by reaction (4) ought to increase systematically at shallower depths because clinopyroxene is stable over a broad depth range. In contrast, garnet peridotites are stable only in deeper levels of the mantle. Hence, a suite of olivine grains derived from the deeper mantle might show a trend of increasing Ca and Ni that reflect shallower and cooler levels in the garnet peridotite zone. However, above the garnet peridotite zone, reaction (6) would be inoperative and the Ni content of olivine would be controlled by other reactions involving silicate and sulphide mineral phases. In the event that sulphide mineral phases are present (Guo, Griffin and O'Reilly 1999), Ni would be expected to partition into the sulphide minerals.

A test of the above model can be made by examination of CaO-NiO variation in olivine from known kimberlites of Ontario using the data of Sage (1996, 2000a, 2000b). Olivine grains from kimberlites of the Kirkland Lake swarm (Figures 15a, b) show wide variation in CaO and NiO. At low levels of CaO (<0.03 wt %), NiO increases slightly from about 0.35 to 0.4 wt% however at higher levels of CaO, the Ni content of olivine drops off abruptly to values <0.2 wt% (compare Figure 15b and Figure 15a). The trend of increasing NiO at low levels of CaO is what would be expected for olivine grains that equilibrated at various depths and temperatures in the garnet peridotite zone. The trend of decreasing NiO at more elevated levels of CaO possibly reflects olivine grains that equilibrated well above the garnet peridotite zone. Very high CaO (>1.0 wt%) may indicate rapid chilling of the kimberlitic magma at high crustal levels.

Olivine grains from kimberlites of the Attawapiskat swarm lack the high CaO that is evident in some grains from the Kirkland Lake swarm and show variable NiO (Figure 15c). Although most grains have from 0.3 to 0.4 wt % NiO at low CaO, some grains, particularly those from the India pipe have low levels of NiO (<.2 wt%) at low CaO. The highly scattered nature of the data prevents drawing conclusions in terms of the above model except to note that the suite of analyses may represent grains drawn from a complex transitional area at the top of the garnet peridotite zone.

Olivine data from the northern Superior area include a few examples with very low NiO plotting near the origin of Figure 15d and 8 grains that have 0.35 to 0.4 wt % NiO at low CaO and show a trend of increasing NiO with CaO. Although the grains with very low Ni and low Ca are unexplained, the compositions of the 8 olivine grains with higher NiO could reflect a range of depths and temperatures in the garnet peridotite zone. It must be emphasised that the data provides no indication of the means by which the grains were brought to surface although the comparable CaO-NiO systematics with olivines from Ontario kimberlites suggests that a kimberlitic source is possible for at least some of the olivine grains found in the sand from the northern Superior area.

Garnet

Heavy mineral concentrates typically contain a high proportion of crustal garnet that has originated from metamorphosed supracrustal rocks including metasedimentary migmatites and metavolcanic gneisses. A major goal of kimberlite prospecting is to distinguish the crustal garnets from those that have originated at deeper levels in the crust and mantle and have been brought to surface in kimberlite diatremes.

Two principal sources of garnet from depth are recognized. These include garnet peridotite and eclogite. Peridotitic garnets are composed mainly of the Cr-pyrope (Mg-rich) end-member and can be recognized at the picking stage by a distinct purple to wine-red colour. Eclogitic garnets tend to be orange and hence are difficult to distinguish from Fe-rich crustal garnets that range in colour from pink through red and orange.

Two hundred and sixteen garnets were analyzed by microprobe. These grains represent a selection that is somewhat biased toward purple and orange varieties of garnet. Preliminary analysis, summarized in Table 8, indicates that the analyzed garnets are composed of mainly pyrope and almandine end-member compositions. A few spessartine and grossular grains including one uvarovite (Cr-grossular) were found. Whereas most purple and red garnets are composed of pyrope and almandine respectively, the compositions of orange garnets show a broad range of pyrope and almandine components with a somewhat elevated (about 20 %) grossular component.

Peridotitic garnets are readily distinguished from crustal and eclogitic garnets in terms of Cr_2O_3 (Figure 16a). In this instance, a separation at 0.5 wt % Cr_2O_3 divides the garnet population into two approximately equal groups representative of the peridotitic and mixed crustal/eclogitic sources. Garnets within peridotitic xenoliths have been studied extensively (e.g. Dawson and Stevens 1975) and can be further subdivided into groups corresponding with wherlite, lherzolite and harzburgite sources on the basis of decreasing CaO. Cr-poor megacrysts represent a fourth source of upper mantle garnet that is broadly comparable to lherzolitic sources and is characterized by garnet with <4.0 wt% Cr_2O_3 and > 0.4 wt % TiO_2 (Schulze 1997). Diamonds from most economic deposits have associated garnets that are representative of harzburgitic sources. The harzburgitic garnets are important indicators and can be recognized by Cr_2O_3-CaO systematics (Dawson and Stephens 1975).

Cr-pyrope garnets from the northern Superior area appear to have originated mainly from lherzolitic sources including Cr-poor megacrysts (Figure 16b). Ten grains fall in or near the harzburgitic or "G10" compositional field of Dawson and Stephens (Figure 16c) and are found almost exclusively west of the Sachigo moraine (Figure 17).

The second major group of garnets comprises those from eclogitic and crustal sources. Separation of these two types of garnet can be done on the basis of FeO content with eclogitic garnets having <22 wt % FeO (Schulze 1997; Figure 16d). Care must be taken to exclude spessartine and grossular garnets from the data as they will tend to plot with eclogites at this stage. Eclogitic garnets from the northern Superior area are representative of Group II eclogites (McCandless and Gurney 1989) with low TiO_2 and low Na_2O (Figure 16e). In reviewing the compositions of garnets from diamondiferous eclogites, McCandless and Gurney (1989) noted that economic diamond deposits are associated with the Na-enriched garnets of the Group I variety. Group II eclogitic garnets of the present survey occur mainly west of the Sachigo Moraine in the Pierce and Stull Lakes area with three grains having been identified east of the moraine at McLeod Lake.

Ilmenite

Ilmenite is a common mineral in Ontario kimberlites (Sage 1996, 2000a, 2000b). Kimberlitic ilmenite is typically Mg-rich (8.0 to 12.0 wt %) and Cr-rich (1.0 to 5.0 wt %) and in most instances can be readily distinguished from Mg- and Cr-depleted ilmenite that is representative of crustal rocks. The composition of ilmenite is also widely used to estimate oxygen fugacity of the mantle and kimberlitic magmas (Haggerty and Tompkins 1983) and the potential for diamonds to be preserved in kimberlite. Gurney and Moore (1993) proposed that ilmenite with a large hematite component (low MgO) indicates oxidizing conditions and a low potential for diamond preservation.

Although Fipke, Gurney and Moore (1995) cited references to rare intergrowths and inclusions of ilmenite in diamond, the association of ilmenite with diamond is not common. Hence, ilmenite cannot be directly used to infer the presence of diamond unlike minerals such as G10 garnets, Group I eclogitic garnets and Mg-rich chromites that have a proven association with economic grades of diamond in known deposits. None-the-less, compositionally representative ilmenite grains in surficial materials can provide a useful prospecting guide to kimberlite.

Ilmenite grains from surficial materials of the northern Superior area are divided into Mg-rich (> 4.0 wt % MgO) and Mg-poor (< 4.0 wt % MgO) varieties in Table 8. Also listed are ilmenite compositions from known crustal sources including gabbro dikes of the Molson and MacKenzie swarms and komatiites.

Two compositional groups of ilmenites from the northern Superior area are distinguished (Figure 18a and Figure 18b). The first group is depleted in MgO and Cr_2O_3 and is composed essentially of the ilmenite end-member molecule. Ilmenite grains from known crustal sources including gabbro dikes of the Molson and MacKenzie swarms and komatiite from the Ponask-Sachigo Lakes area fall into this group. Hence, it can be inferred that Mg- and Cr-depleted ilmenite in surficial materials can be derived from crustal sources.

Ilmenite grains from group 2 contain 8.0 to 10.0 wt % MgO and 1.0 to 5.0 wt % Cr_2O_3 (Figure 18b) and plot within the field of kimberlitic ilmenite defined by Haggerty and Tompkins (1983) in Figure 18a. Also shown for comparison in Figure 18c and Figure 18d are selected ilmenite compositions from kimberlites of the Kirkland Lake and Attawapiskat swarms (Sage 1996, 2000a, 2000b). The kimberlitic ilmenites are virtually identical to the second group of ilmenites from surficial materials in terms of the proportions of ilmenite, geikielite and hematite molecules as well as Cr-content. The kimberlitic ilmenites and group 2 ilmenites plot low in the kimberlitic field and the low content of Fe_2O_3 implies favourable conditions for diamond preservation.

On the basis of the above comparison, it appears that the enriched ilmenites (group 2) found in surficial materials of the northern Superior area may have originated from kimberlite. Like other indicators, the potentially kimberlitic ilmenites are concentrated in beaches west of the Sachigo moraine but also occur widely in a variety of materials east of the Sachigo moraine (Figure 19).

Chromite

Chromite represents one end-member composition in the spinel group of minerals and occurs widely in mafic to ultramafic rocks. The compositional variations between chromite and other spinel group minerals have been used to infer the geological environment and magmatic conditions in which the minerals grew (see summary of Roeder 1994). For example, chromite compositions have been used to estimate olivine compositions and magma temperatures in mafic intrusions (Irvine 1965, 1967) and to subdivide intrusions according to tectonic setting (Dick and Bullen 1984), to distinguish mineralized from non-mineralized komatiites (Groves et al. 1977) and to estimate the diamond potential of kimberlites (Fipke, Gurney and Moore 1995). Further work has shown however that the composition of chromite can be metamorphically altered (Barnes 2000) and that petrogenetic discrimination models based on chromite need to be interpreted with caution (Power et al. 2000).

Mitchell (1986) subdivided kimberlitic spinels in an eight-component system $MgCr_2O_4$ (magnesiochromite)-$FeCr_2O_4$ (chromite)-$MgAl_2O_4$ (spinel)-$FeAl_2O_4$ (hercynite)-Mg_2TiO_4 (magnesian ulvospinel)-Fe_2TiO_4 (ulvospinel)-$MgFe_2O_4$ (magnesioferrite)-Fe_3O_4 (magnetite). Compositional variations between these end-members can be graphically illustrated by trend lines on 6-component prisms such as the reduced spinel prism (Haggerty 1975; Figure 20) in which the magnesioferrite and magnetite components are omitted.

Mitchell (1986) summarized research on spinel zonation and defined several trends in the compositional variation of spinel group minerals that have crystallized in kimberlite. Spinels crystallized according to magmatic trend 1 have compositions transitional between $MgCr_2O_4$ and $FeCr_2O_4$ at an early stage and evolve toward Mg_2TiO_4 -Fe_2TiO_4 at a late stage. This trend is marked by increasing Ti, Fe^{3+}/Fe^{2+} and total Fe and decreasing Cr at approximately constant $Fe^{2+}/(Fe^{2+}+Mg)$ and is probably due to oxidation during crystallization of the kimberlitic melt (Roeder 1994). Ferrous iron is oxidized to ferric iron but the high Mg-content of the magma keeps the $Fe^{2+}/(Fe^{2+}+Mg)$ ratio approximately constant. Magmatic trend 2 causes the compositions of successively crystallized spinels to evolve from $MgCr_2O_4$-$FeCr_2O_4$ toward $FeCr_2O_4$ and subsequently to Fe_2TiO_4. This trend is marked by rapidly increasing $Fe^{2+}/(Fe^{2+}+Mg)$ ratios at low Ti and high Cr/(Cr+Al) followed by a rapid increase in Ti at high $Fe^{2+}/(Fe^{2+}+Mg)$.

In addition to spinels that have crystallized directly from the magma, kimberlites also contain xenocrystic spinels that have been incorporated as a result of the breakdown of wallrock xenoliths within the melt and have undergone variable reaction with the melt. These spinels are representative of parts of the mantle through which the kimberlitic magma has traversed and, in a general sense are compositionally similar to the more primitive spinels that grew within the kimberlitic magma. These have low Ti and Fe^{3+} and variable Cr (Roeder 1994) with high-Cr varieties coming from harzburgite and dunite and low-Cr varieties derived from lherzolite.

Fipke, Gurney and Moore (1995) examined a large spinel database and defined simple graphical procedures for distinguishing spinels associated with kimberlite as well as diamondiferous kimberlite. These authors noted that some kimberlitic spinels (presumably those that crystallized late in the magmatic trends discussed above) have high TiO_2. They used this observation to define a field of spinel compositions that is unique to kimberlite and lamproite on a graph of Cr_2O_3 vs. TiO_2. Fipke, gurney and Moore (1995) also noted that spinels that occur as inclusions or intergrowths with diamond have very high Cr_2O_3 (>~60 wt %) combined with high MgO (>9 wt %). A diamond inclusion field was defined on a Cr_2O_3-MgO plot and is useful for distinguishing kimberlitic spinels that may be associated with diamond.

Ni-Zn systematics provide insight on temperature conditions under which spinels crystallized. Griffin et al. (1993; 1994) calculated temperatures of garnet+spinel peridotites using the Ni-in-pyrope thermometer. They noted that the Zn content of chromite decreases whereas the Ni content of chromite increases with temperature. The Zn-content of chromite follows a temperature-dependent exchange of this element with olivine. Ni relations are more complex involving temperature-dependent exchange between olivine and pyrope according to reaction (6) above as well as olivine and spinel. Hence, chromite with low Zn and high Ni is characteristic of high temperatures and the above authors calculated that xenocrystal chromites from garnet+spinel peridotites of the diamond stability field ought to have Zn < 700 ppm and Ni > 600 ppm.

Amphibolite grade metamorphism tends to cause chromite to be depleted in Ni and enriched in Zn (Barnes 2000) and the metamorphic enrichment of Zn tends to be somewhat greater than the depletion of Ni. Although it can be assumed that this effect should be minimal in kimberlitic spinels that post-date regional Archean metamorphic events it is also possible that the compositions of old non-kimberlitic spinels can be metamorphically transformed to appear kimberlitic. Generally, chromites with high Zn regardless of Ni content have probably formed or have been metamorphosed near surface.

Zn and Ni are present in trace quantities in chromite and care must be exercised to ensure that the detection limit of a conventional microprobe is sufficiently low to accurately measure these elements. A further shortfall in applying the Ni-Zn systematics to detrital chromites is that the original mineral assemblage with which the grains equilibrated is not known and must be assumed. None-the-less chromites with low Zn and high Ni can be considered to have formed under high temperatures characteristic of the source areas for kimberlitic magmas.

Chromite data from the northern Superior area are shown in Figures 20a to e. The detrital chromite grains are divided into two groups comprising those of possible kimberlitic origin (as distinguished by chemical criteria discussed below and shown by solid circles) and those from other or unknown and possibly mixed kimberlitic and crustal sources (open circles). Also shown for comparison are 4 analyses of chromites from komatiite of the northern Superior area. The fields of chromite compositions from Ontario kimberlites (Sage 1996, 2000a, 2000b) and from non-kimberlitic chromites of northwest Ontario are illustrated. The latter data of Watkinson and Mainwaring (1982) represents sub-economic chromite deposits at Chrome Lake, Shebandowan-Loch Erne, Crystal Lake and Big Trout Lake.

Chromite compositions are conventionally shown in terms of ratios of Cr/(Cr+Al) and $Fe^{3+}/(Fe^{3+}+Cr+Al)$ against $Fe^{2+}/(Fe^{2+}+Mg)$. The northern Superior chromites have high Cr/(Cr+Al) (0.6 to 0.8) and low $Fe^{3+}/(Fe^{3+}+Cr+Al)$ (<0.2) with quite variable $Fe^{2+}/(Fe^{2+}+Mg)$. These plots (Figure 20a and Figure 20b) show considerable overlap between the compositions of the detrital grains and those in known kimberlites and crustal sources and hence, provide little power to discriminate the origin of the detrital grains.

In terms of Cr_2O_3-MgO systematics (Figure 20c) none of the northern Superior chromites and very few chromites from Ontario kimberlites plot within the diamond stability field of Fipke, Gurney and Moore (1995). Griffin et al. (1994) noted that chromite inclusions within diamond show much higher Cr_2O_3 than chromite on the surface of diamond grains or in peridotite adjacent to diamond. They reasoned that diamonds and included spinels are older and must have formed at higher temperatures than existed in the host peridotite at the time of kimberlite eruption. Hence, diamond inclusion spinels ought to be rare in kimberlites and the lack of these kinds of spinels in a suite of samples should not be interpreted as indicating the absence of a kimberlitic source. The available evidence summarized by Griffin et al. (1994) suggests that Cr_2O_3

increases with T and P in chromite. Thus, chromite with high Cr_2O_3 lying just below the diamond inclusion field (*see* Figure 20c) is most likely to have originated at depth and can be interpreted to be of possible kimberlitic origin.

Most northern Superior chromites have less than 1 wt% TiO_2 (Figure 20d) although a few grains have higher levels of TiO_2 plotting within or near the field unique to kimberlite and lamproite. Evidently, these represent spinels that crystallized late in the evolution of kimberlitic magmas toward the end of magmatic trends 1 and 2 that are characterized by Ti enrichment.

ZnO and NiO are inversely correlated in northern Superior chromites (Figure 20e). Chromite from Ontario kimberlites shows a similar inverse relation between ZnO and NiO and is low in ZnO (<0.4 wt %) but somewhat variable in NiO up to 0.3 wt %. The low Zn is an indication of high temperatures of chromite formation whereas the variable NiO probably reflects a high proportion of chromite that crystallized in the absence of pyrope at higher levels in the lithosphere. A ZnO level of <0.4 wt % combined with a somewhat arbitrary cut-off of >0.15 wt % NiO can be used to infer a high temperature and possibly kimberlitic source for chromite. A subset of possibly kimberlitic spinels have compositions with <0.09 wt % ZnO and >0.75 wt % NiO representative of the diamond stability field in a spinel+garnet peridotite (Griffin et al. 1994).

Table 12 ia a summary of grain compositions that satisfy one or another of the three criteria used to identify chromite of possible kimberlitic origin. The grains are shown by solid circles in Figure 20 and are identified by high Cr and Mg (near the diamond stability field of Figure 20c), high Ti (in or near the field unique to kimberlite or lamproite of Figure 20d) or high Ni with low Zn (Figure 20e). Very few grains satisfy all three criteria, which partly reflects the variable conditions of pressure, temperature and bulk composition at which spinels form or are incorporated into a kimberlite. It must be emphasised however that considerable overlap occurs in spinel compositions from kimberlitic and non-kimberlitic sources and the above criteria does not uniquely differentiate between the sources.

Chromite of possible kimberlitic origin is distributed widely in the northern Superior area (Figure 21). Chromite grains occur at western Stull Lake and four grains are found in one sample at Ponask Lake west of the Sachigo moraine. Chromite of possibly kimberlitic origin appears to occur in a broad band south of the Kenyon faults east of the Sachigo moraine.

Implications for Kimberlite Exploration

The number of "raw" kimberlite indicator minerals whose distribution is shown in Figures 9 and 10 have been reduced by chemical discrimination. The more chemically favourable kimberlite indicator minerals discussed in the text and shown in Figures 14, 17, 19 and 21 occur widely and, in total, show a similar distribution to the "raw" indicator minerals. Chrome diopside, G10 garnet, eclogitic garnet and olivine tend to be concentrated west of the Sachigo moraine whereas ilmenite and chromite occur everywhere possibly showing a slight concentration east of the moraine.

West of the Sachigo moraine, samples with anomalous numbers of kimberlite indicator minerals are scattered in a southerly direction through the Stull-Ponask lakes area parallel to the latest direction of ice movement. Anomalous samples west of the Sachigo moraine including 96DST103, 97DST103, 95DST208, 99DST48, 00DST108, 95DST121 and 00DST16 (*see* Table 6) are taken from beach and river samples, some of which show evidence of placer concentration of heavy minerals (large HMCs). The concentration of kimberlite indicator minerals in these samples may be at least partly due to placer effects. Further, 3 of these samples (95DST208, 99DST48 and 00DST108) were taken from the same beach in consecutive seasons and cause the number of indicator minerals to be biased upward in the western Stull Lake area.

The surfaces of chromite grains in samples collected west of the Sachigo moraine are moderately rounded and chipped. The rounding and chipping post dates crushing of grains by the main glacial deformation event and possibly results from a second glacial deformation event related to southerly advance of the western ice lobe and subsequent melting of this lobe. Although pyrope grains west of the Sachigo moraine are mostly angular, the angularity of pyrope probably results from the brittle nature of the mineral and should not be interpreted as an indication of proximity to source.

East of the Sachigo moraine, kimberlite indicator minerals tend to be concentrated in a linear zone about 30 km southwest of the North Kenyon fault (Figure 9) that includes beaches at McLeod Lake. The majority of chromite grains show effects of glacial crushing with somewhat less post-crushing abrasion than is apparent in chromite grains west of the moraine. A subset of 3 chromite grains from east of the moraine are highly rounded and have probably had a more complex displacement path than the majority of chromite grains. It is encouraging to note that the only chromite grain that shows remnants of an orange-peel surface suggestive of a kimberlitic origin (00DST201) is also distinguished by high Cr and Ni (compare data in Table 11 and Table 12).

In summary, although the largest numbers of kimberlite indicator minerals are concentrated in the Stull-Ponask lakes area, the moderately worn surfaces of chromite grains and placer concentration of dense minerals in some samples suggests that these grains have been displaced and sorted by movement of ice and water. The late, southerly ice advance and subsequent glaciofluvial activity may account for some of the extra component of wear and inherent displacement of grains on the west side of the Sachigo moraine. East of the Sachigo moraine, kimberlite indicator minerals tend to be concentrated in samples aligned perpendicular to the latest ice advance. On the one hand, the alignment of indicator mineral-bearing samples suggests that the KIMs may have been concentrated in a glacial feature such as a terminal moraine or paleo-beach developed perpendicular to the ice-movement direction. Inspection of air photographs and field observations provide no clear evidence for this interpretation however. On the other hand, samples containing the largest numbers of indicator minerals are aligned parallel to regional faults and terrane boundaries. This alludes to an interpretation wherein the source or sources for kimberlite indicator minerals may be controlled by regional crustal structures.

The northern Superior superterrane lying north of the North Kenyon fault represents some of the oldest preserved crustal material in the Superior Province (Skulski et al. 2000). Old terranes tend to have thick, cold mantle roots and hence provide a favourable environment in which ancient diamonds can be preserved to be picked up and brought to surface in young kimberlites

(Hoffman 1990; Gurney, Helmstaedt and Moore 1993). Hence, the northern Superior superterrane may provide an attractive area to be explored for diamondiferous kimberlite.

In comparison, Fedikow et al. (2001a, 2001b) summarized extensive sampling for kimberlite indicator minerals in the Knee Lake area of Manitoba, which lies approximately 150 km west-northwest of the study area. These authors noted anomalous numbers of kimberlite indicator minerals in surficial materials at Knee Lake and concluded that the source of the indicators lies up-ice to the northeast. Possibly the indicator minerals at Knee Lake and those of the present area are derived from sources that are grossly associated with the northern Superior superterrane and its boundaries. Although the majority of kimberlite indicator minerals found during this study occur south of the North Kenyon fault, a few grains occur northward within the northern Superior superterrane. Further sampling north and northeast of the study area is required to constrain bedrock sources of the indicator mineral grains.

Conclusions

A variety of surficial materials comprising mainly beach sand and till were sampled concurrent with bedrock mapping in the northern Superior area from 1995 to 2000. The samples were processed for gold grains, metamorphosed magmatic sulphide indicator minerals (MMSIMs®) and kimberlite indicator minerals (KIMs).

A detailed study focused exclusively on till identified anomalous numbers of gold grains in the area of the Sachigo River mine. In contrast, regional sampling produced very few gold grains through most of the northern Superior area probably because the sampling medium was predominantly sand-size beach material from which silt-size gold grains had been removed by water action. Sample 96DST202 at Ponask Lake contains 18 gold grains and represents an isolated anomaly that is worthy of follow-up. Otherwise, it is concluded that till is a preferred medium to be sampled for gold grain studies.

Samples containing anomalous MMSIMs® include those with chalcopyrite only, Mn-epidote with Cr-diopside and chalcopyrite+Mn-epidote+Cr-grossular+arsenopyrite. The chalcopyrite-only samples typically occur in plutonic areas and these anomalies appear to represent the accumulation of sulphide grains that have originated from weak disseminations in nearby plutonic bedrock. Two samples of beach sand with anomalous numbers of Mn-epidote and Cr-diopside grains are characterized by oversized heavy mineral concentrates. It appears that the MMSIMs® have been concentrated together with other heavy minerals in these samples at least partly by placer effects although one sample (97DST05) occurs within an area of the western Stull Lake greenstone belt that is geologically favourable for mineralization. Sample 96DST100 from Ponask Lake contains a multi-mineral suite of MMSIMs® (chalcopyrite+Mn-epidote+Cr-grossular+arsenopyrite) and appears to be an attractive anomaly, possibly associated with volcanogenic massive sulphide mineralization.

Surficial materials of the northern Superior area contain anomalous numbers of kimberlite indicator minerals. The KIMs include Cr-diopside, forsterite, Cr-pyrope, low-Ti and Cr almandine-pyrope, ilmenite and chromite and appear to have originated from lherzolite and lesser components of harzburgite and eclogite. West of the Sachigo moraine, samples with anomalous KIMs are distributed in a southerly direction parallel to the latest ice-movement direction. East of the Sachigo moraine, KIMs are scattered but show some alignment parallel to northwest-striking regional bedrock structures and perpendicular to the regional ice-movement direction.

The surfaces of nearly all chromite grains show effects of sub-glacial crushing followed by chipping, cracking and grinding in a glacial or aqueous environment. A few grains are well rounded and may represent a separate population of KIMs that were extensively worn in kimberlite or water prior to glaciation. Evidently, the KIMs have been displaced an unknown and probably significant distance by ice and water. East of the Sachigo moraine, ice has displaced the grains southwesterly whereas west of the Sachigo moraine, more complex glacial dynamics prevailed and involved early southwesterly displacement followed by southerly movement.

The northern Superior superterrane, which lies north of the North Kenyon fault is one of the oldest (3.5 Ga) continental fragments in the Superior Province. Old continental masses can be underlain by deep and cold roots of refractory mantle material within which diamonds can form and be preserved and subsequently brought to surface in kimberlite diatremes. The northern Superior superterrane represents a favourable region to be explored for fertile kimberlites.

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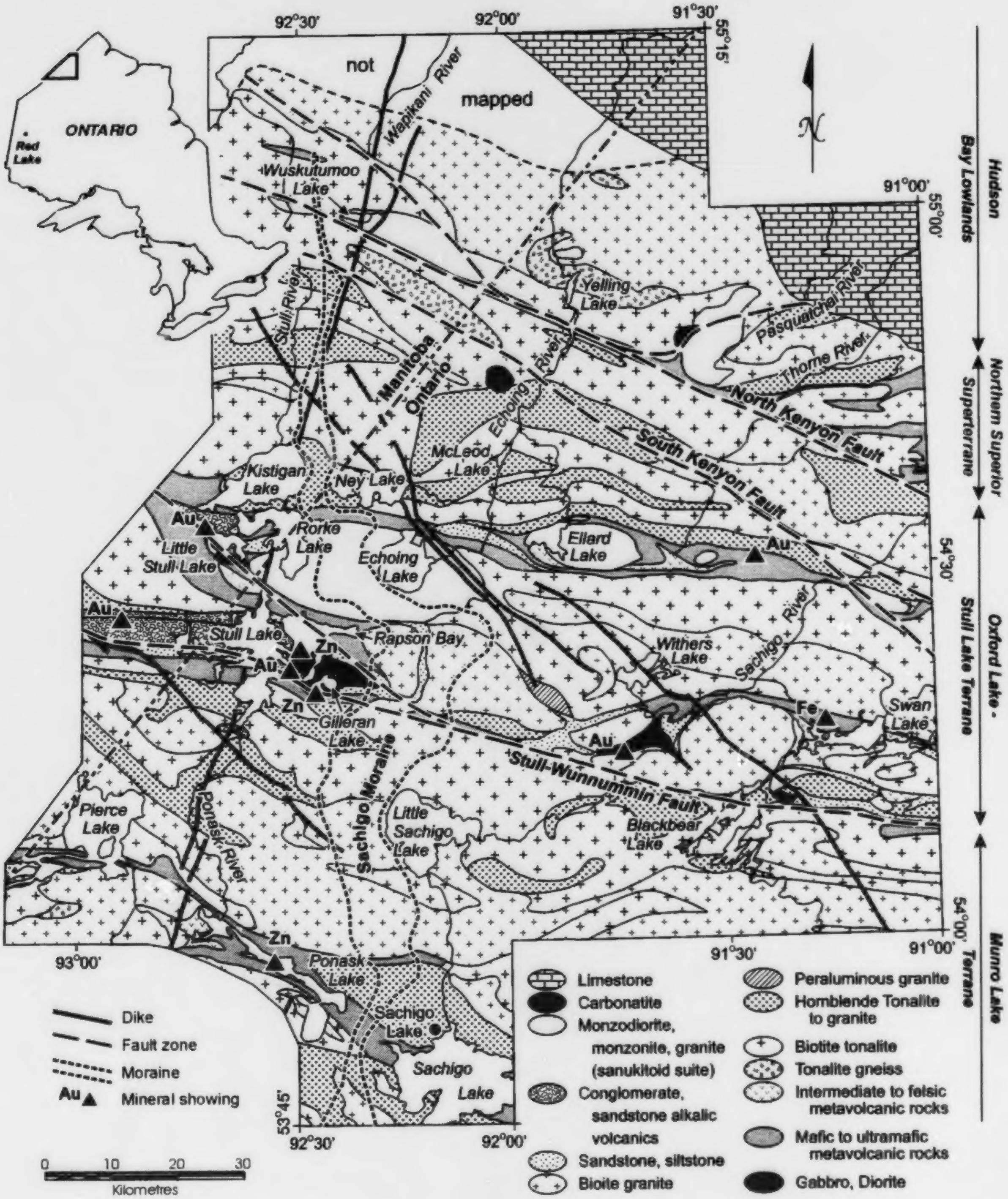
92°30'
92°00'
91°30'
55°15'
91°00'
55°00'
54°30'
54°00'
93°00'
53°45'
not mapped
ONTARIO
Red Lake
N
Hudson Bay Lowlands
Northern Superior Superterrane
Oxford Lake - Stull Lake Terrane
Munro Lake Terrane
Wapikani River
Wuskutumoo Lake
Stull River
Yelling Lake
Pasquatchai River
Thorne River
Manitoba
Ontario
Echoing River
North Kenyon Fault
South Kenyon Fault
McLeod Lake
Kistigan Lake
Ney Lake
Rorke Lake
Echoing Lake
Ellard Lake
Little Stull Lake
Stull Lake
Rapson Bay
Withers Lake
Sachigo River
Swan Lake
Gilleran Lake
Stull-Wunnummin Fault
Sachigo Moraine
Little Sachigo Lake
Blackbear Lake
Pierce Lake
Ponask River
Ponask Lake
Sachigo Lake
Au
Zn
Fe
Dike
Fault zone
Moraine
Au▲ Mineral showing
0
10
20
30
Kilometres
Limestone
Carbonatite
Monzodiorite, monzonite, granite (sanukitoid suite)
Conglomerate, sandstone alkalic volcanics
Sandstone, siltstone
Bioite granite
Peraluminous granite
Hornblende Tonalite to granite
Biotite tonalite
Tonalite gneiss
Intermediate to felsic metavolcanic rocks
Mafic to ultramafic metavolcanic rocks
Gabbro, Diorite

Figure 1: Geology of the northern Superior area

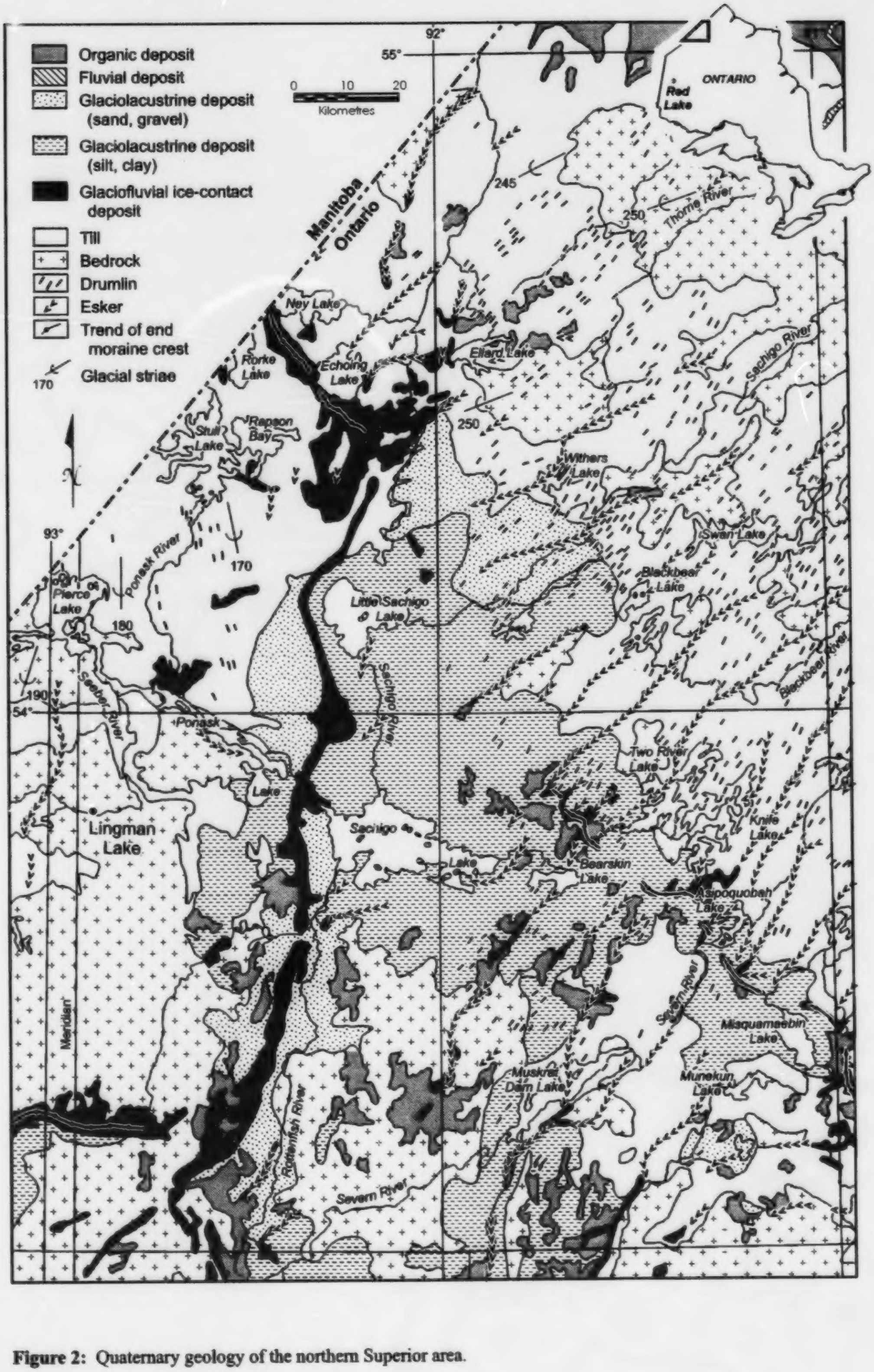
Organic deposit
Fluvial deposit
Glaciolacustrine deposit (sand, gravel)
Glaciolacustrine deposit (silt, clay)
Glaciofluvial ice-contact deposit
Till
Bedrock
Drumlin
Esker
Trend of end moraine crest
Glacial striae
170
0
10
20
Kilometres
92°
55°
93°
54°
ONTARIO
Red Lake
Manitoba
Ontario
245
250
Thorne River
Ney Lake
Rorke Lake
Echoing Lake
Ellard Lake
Sachigo River
250
Rapson Bay
Stull Lake
Withers Lake
170
Ponask River
Swan Lake
Pierce Lake
180
Blackbear Lake
Little Sachigo Lake
190
Seeber River
Sachigo River
Blackbear River
Ponask
Lake
Two River Lake
Lingman Lake
Sachigo
Lake
Knife Lake
Bearskin Lake
Asipoquobah Lake
Meridian
Severn River
Misquamaebin Lake
Muskrat Dam Lake
Munekun Lake
Rottenfish River
Severn River

Figure 2: Quaternary geology of the northern Superior area.

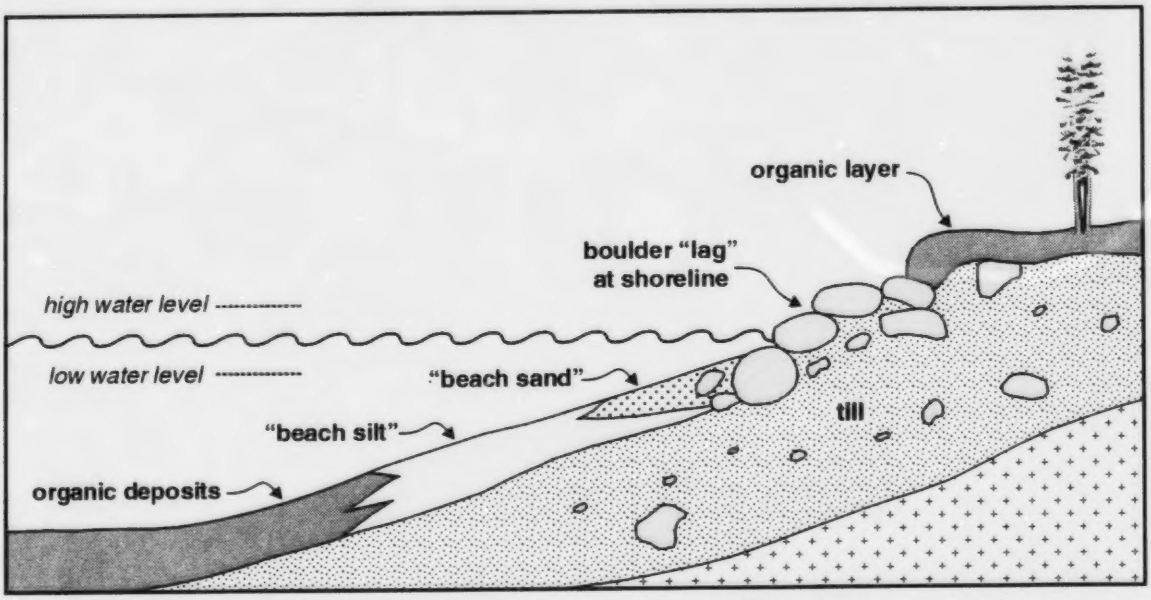
organic layer
boulder "lag" at shoreline
high water level
low water level
"beach sand"
"beach silt"
till
organic deposits

Figure 3: Hypothetical cross-section of the shoreline of a small northern lake.

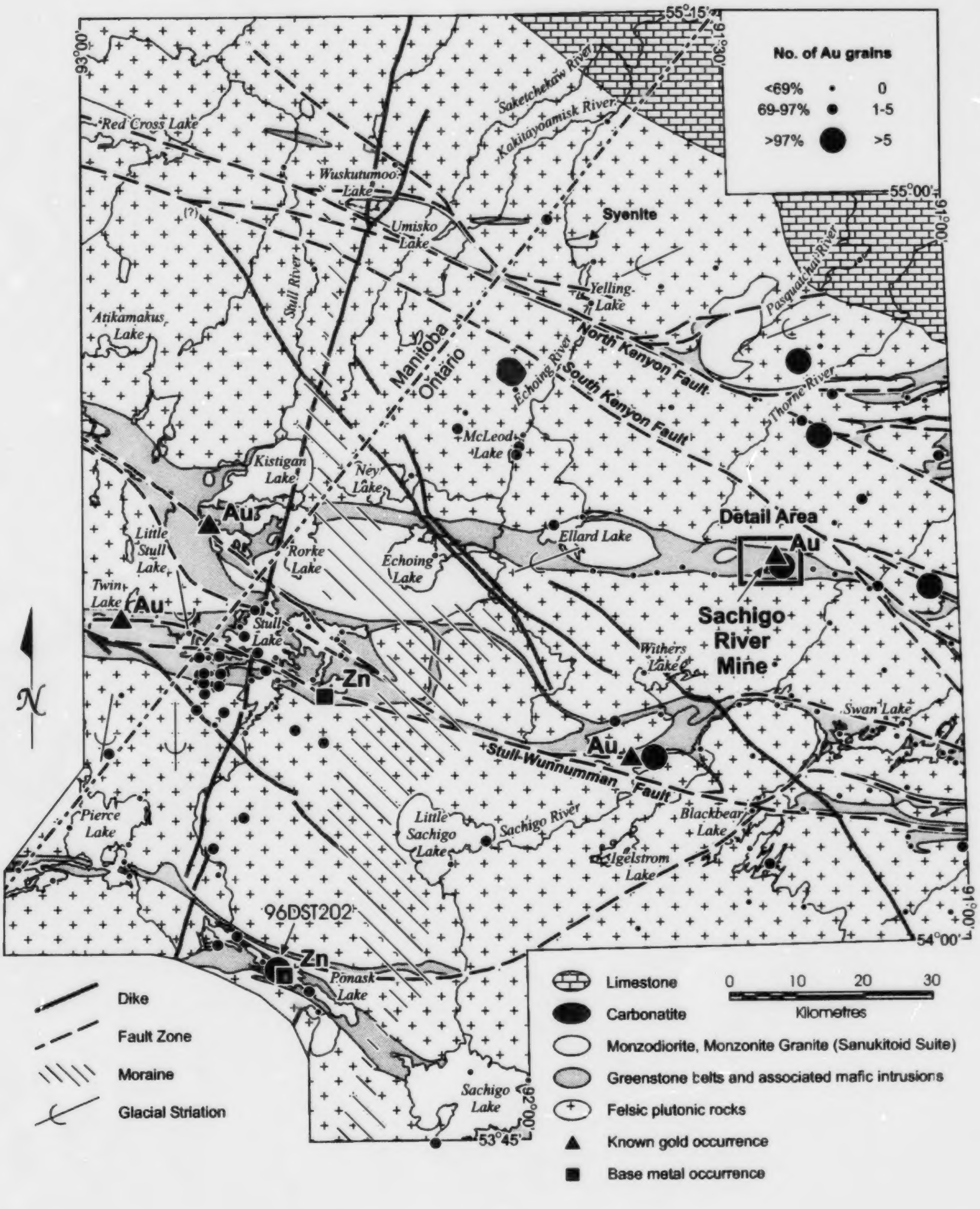
55°15'
91°30'
93°00'
No. of Au grains
<69% • 0
69-97% • 1-5
>97% ● >5
55°00'
91°00'
Red Cross Lake
Saketchekaw River
Kakitayoamisk River
Wuskutumoo Lake
Umisko Lake
Syenite
Yelling Lake
Pasquatchai River
Atikamakus Lake
Stull River
Manitoba
Ontario
North Kenyon Fault
South Kenyon Fault
Echoing River
Thorne River
McLeod Lake
Kistigan Lake
Ney Lake
Detail Area
Au
Ellard Lake
Little Stull Lake
Rorke Lake
Echoing Lake
Twin Lake
Au
Stull Lake
Sachigo River Mine
Withers Lake
Zn
Swan Lake
Au
Stull-Wunnumman Fault
Pierce Lake
Little Sachigo Lake
Sachigo River
Blackbear Lake
Igelstrom Lake
96DST202
Zn
Ponask Lake
54°00'
91°00'
Sachigo Lake
92°00'
53°45'
N
Dike
Fault Zone
Moraine
Glacial Striation
Limestone
Carbonatite
Monzodiorite, Monzonite Granite (Sanukitoid Suite)
Greenstone belts and associated mafic intrusions
Felsic plutonic rocks
▲ Known gold occurrence
■ Base metal occurrence
0 10 20 30
Kilometres

Figure 4: Regional distribution of gold grains, northern Superior area.

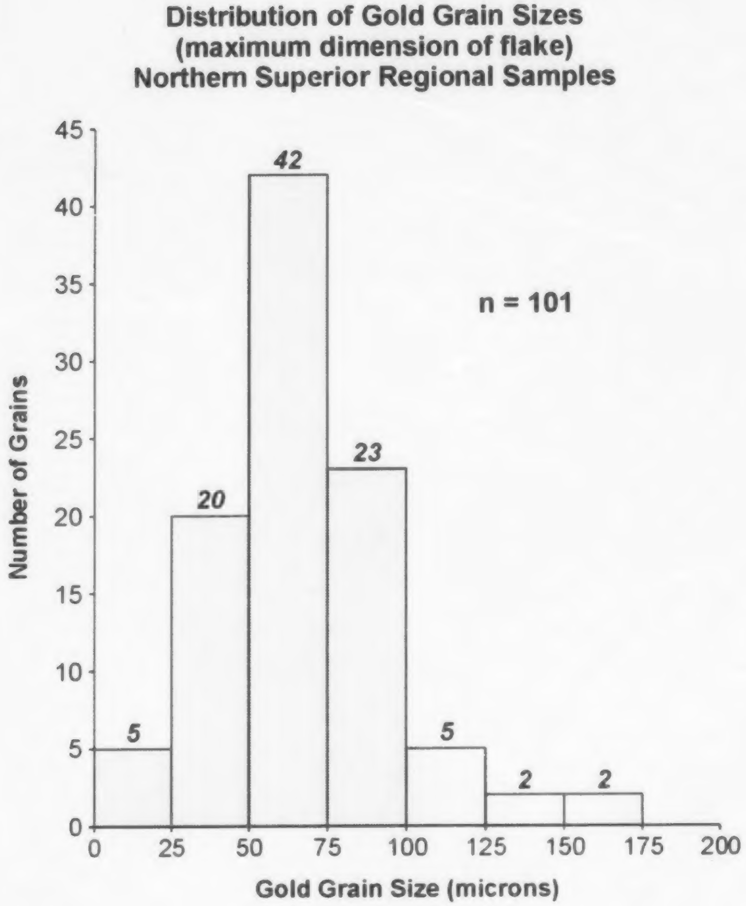

Figure 5: Distribution of gold grain sizes, northern Superior area.

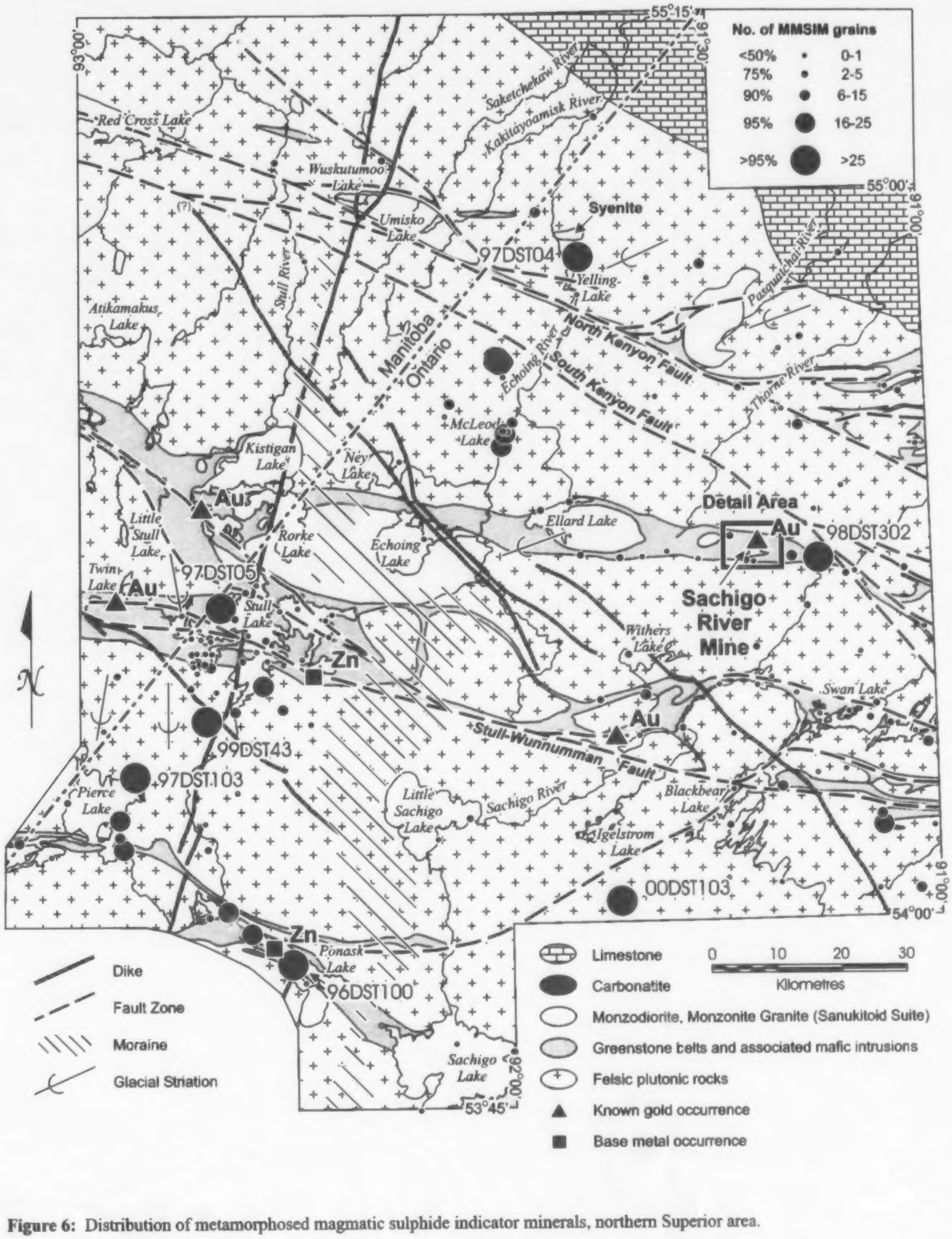
No. of MMSIM grains
<50% 0-1
75% 2-5
90% 6-15
95% 16-25
>95% >25
55°15'
91°30'
93°00'
55°00'
91°00'
54°00'
53°45'
92°00'
Red Cross Lake
Saketchekaw River
Kakitayoamisk River
Wuskutumoo Lake
Umisko Lake
Syenite
97DST04
Yelling Lake
Pasquatchai River
Stull River
Atikamakus Lake
Manitoba
Ontario
Echoing River
North Kenyon Fault
South Kenyon Fault
Thorne River
McLeod Lake
Kistigan Lake
Ney Lake
Au
Detail Area
Au
98DST302
Little Stull Lake
Rorke Lake
Echoing Lake
Ellard Lake
Twin Lake
Au
97DST05
Stull Lake
Sachigo River Mine
Withers Lake
Zn
Swan Lake
N
Au
Stull-Wunnumman Fault
99DST43
97DST103
Pierce Lake
Little Sachigo Lake
Sachigo River
Blackbear Lake
Igelstrom Lake
00DST103
Zn
Ponask Lake
96DST100
Sachigo Lake
Dike
Fault Zone
Moraine
Glacial Striation
Limestone
Carbonatite
Monzodiorite, Monzonite Granite (Sanukitoid Suite)
Greenstone belts and associated mafic intrusions
Felsic plutonic rocks
Known gold occurrence
Base metal occurrence
0 10 20 30
Kilometres

Figure 6: Distribution of metamorphosed magmatic sulphide indicator minerals, northern Superior area.

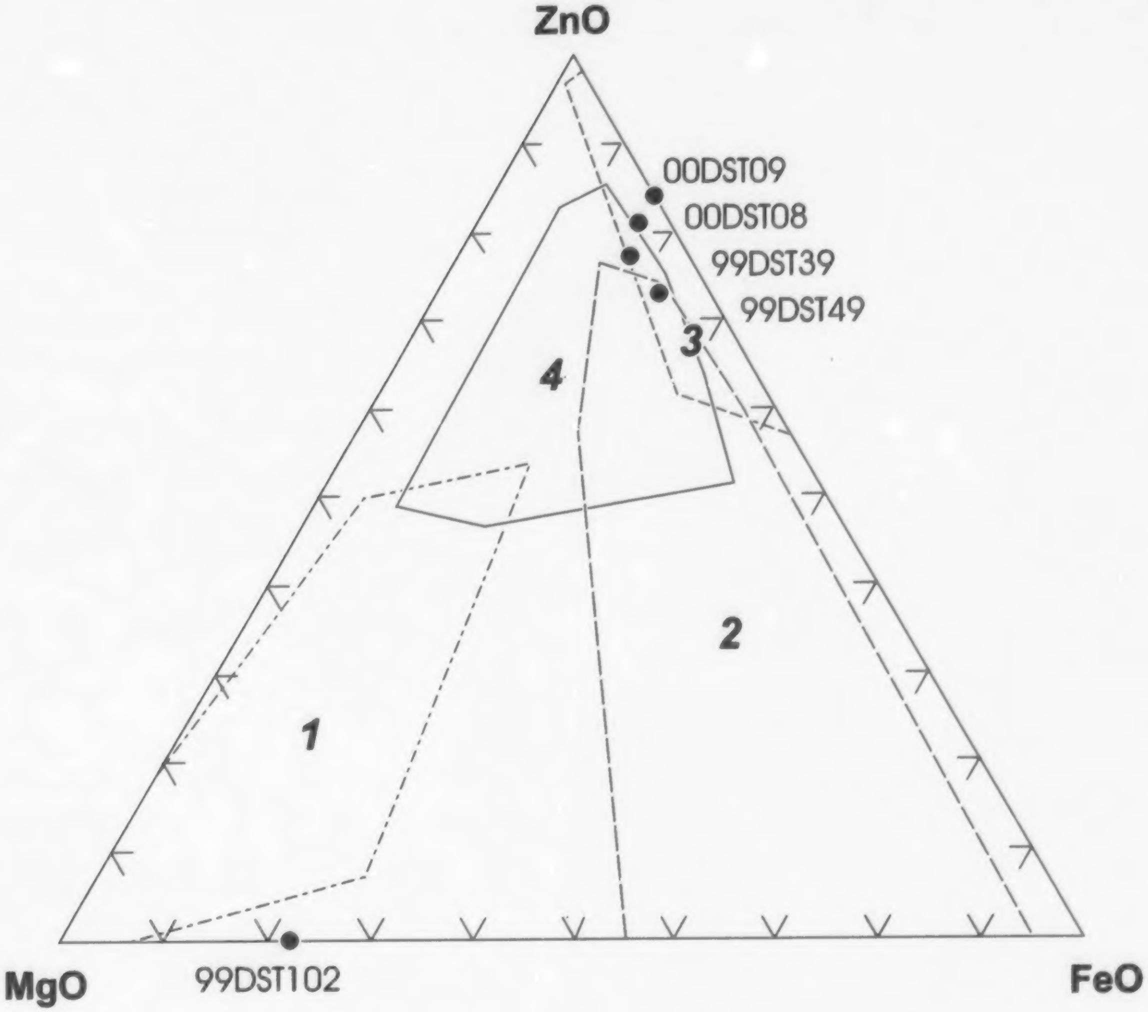

Figure 7: Compositional fields of spinels from marbles *(1)*, aluminous metasediments *(2)*, pegmatites *(3)*, and metamorphosed massive sulphides *(4)* from Dunlop (2000) with superimposed data from the northern Superior area.

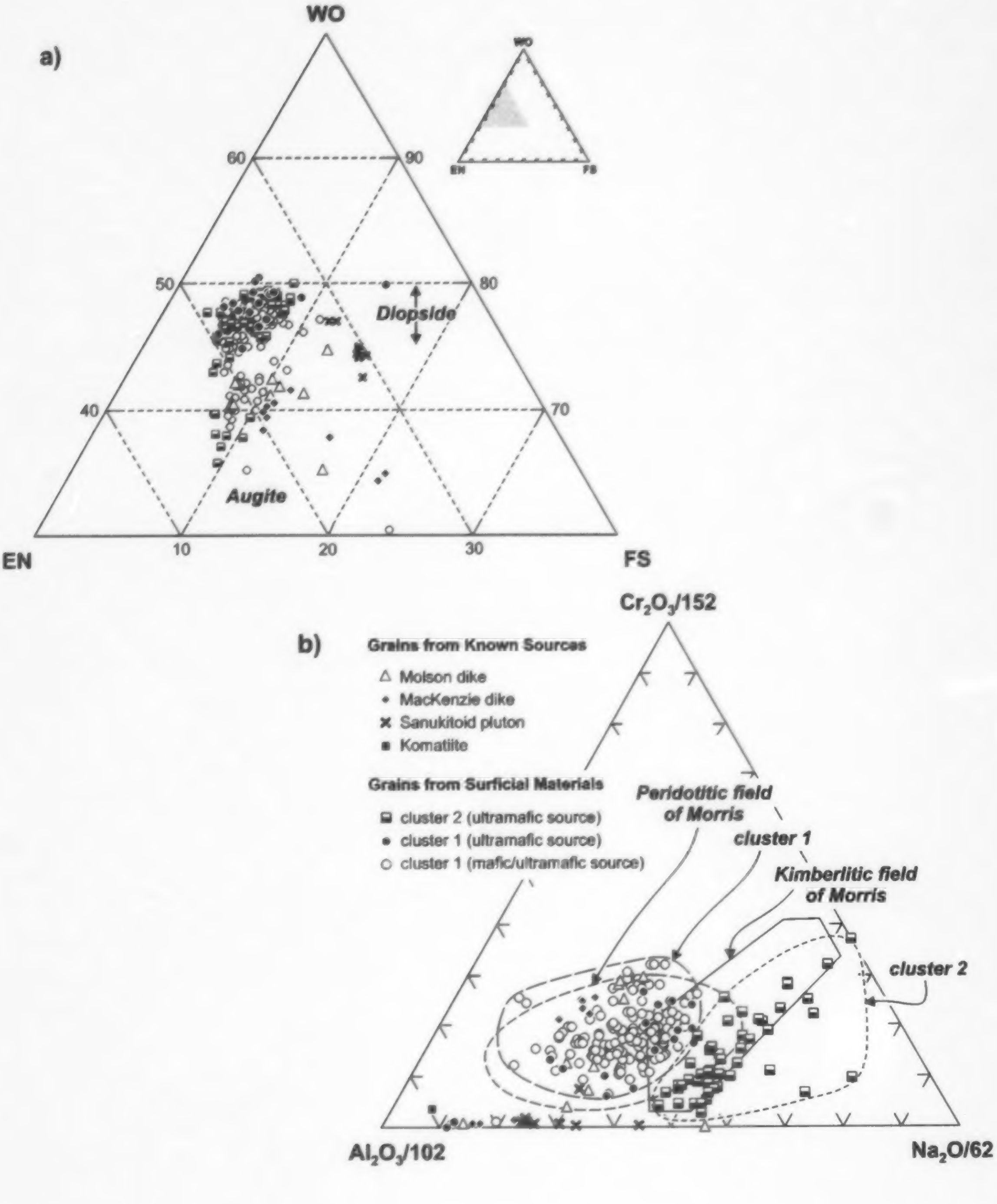

Figure 8: (a) Classification of northern Superior clinopyroxenes on the wollastonite (WO)-enstatite (EN)-ferrosilite (FS) diagram of Morimoto (1986). (b) compositions of northern Superior clinopyroxenes on the Al_2O_3-Cr_2O_3-Na_2O diagram of Morris et al. (unpublished).

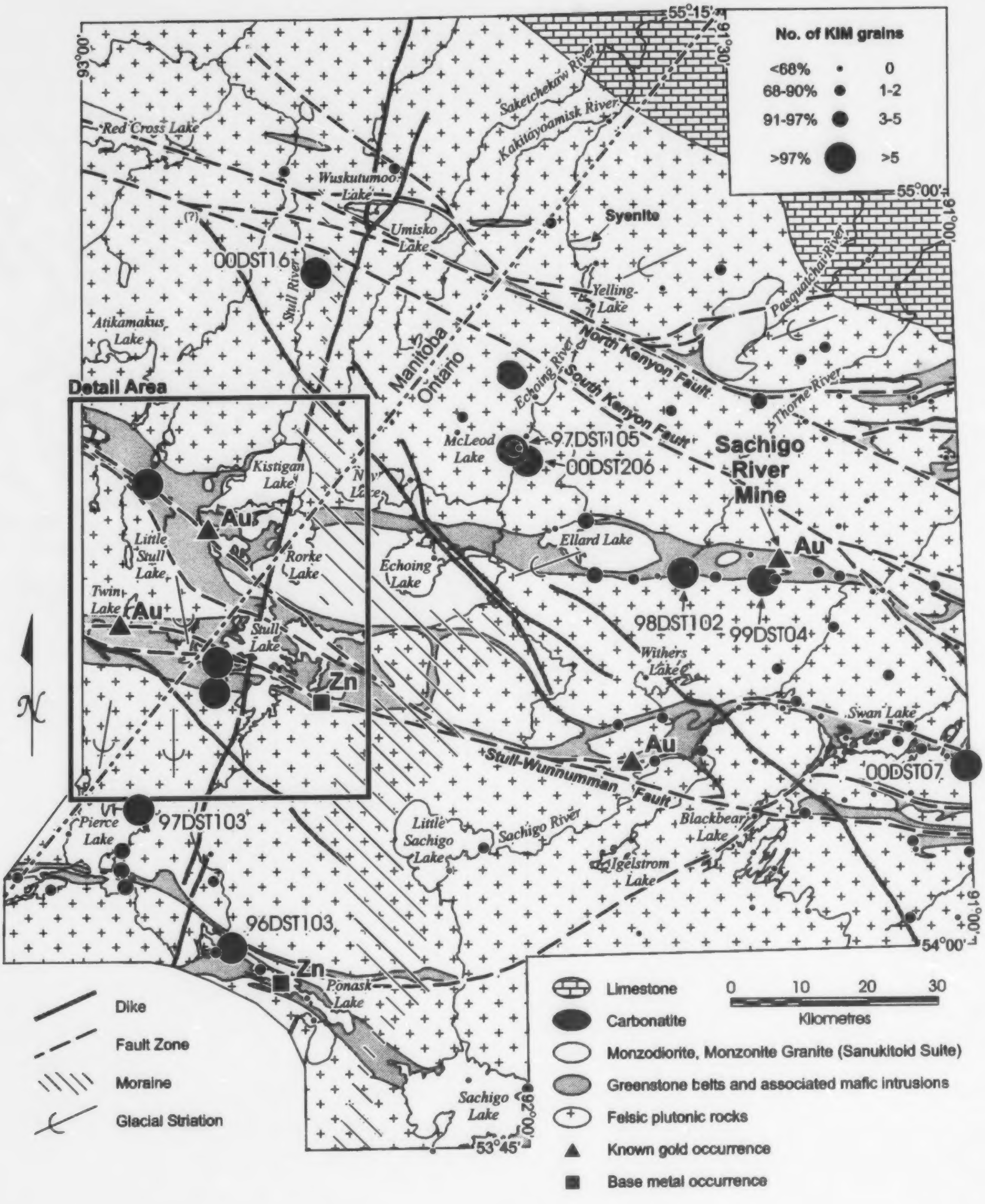
No. of KIM grains
<68% 0
68-90% 1-2
91-97% 3-5
>97% >5
55°15'
91°30'
55°00'
91°00'
93°00'
54°00'
91°00'
92°00'
53°45'
Red Cross Lake
Saketchekaw River
Kakitayoamisk River
Wuskutumoo Lake
Umisko Lake
Syenite
00DST16
Stull River
Atikamakus Lake
Yelling Lake
Pasquatchai River
North Kenyon Fault
South Kenyon Fault
Manitoba
Ontario
Echoing River
Thorne River
Detail Area
McLeod Lake
97DST105
00DST206
Sachigo River Mine
Kistigan Lake
New Lake
Au
Little Stull Lake
Rorke Lake
Echoing Lake
Ellard Lake
Twin Lake
Au
98DST102
99DST04
Stull Lake
Withers Lake
Zn
Swan Lake
Au
Stull-Wunnumman Fault
00DST07
97DST103
Pierce Lake
Little Sachigo Lake
Sachigo River
Blackbear Lake
Igelstrom Lake
96DST103
Zn
Ponask Lake
Sachigo Lake
Dike
Fault Zone
Moraine
Glacial Striation
Limestone
Carbonatite
Monzodiorite, Monzonite Granite (Sanukitoid Suite)
Greenstone belts and associated mafic intrusions
Felsic plutonic rocks
Known gold occurrence
Base metal occurrence
0 10 20 30
Kilometres
N

Figure 9: Distribution of kimberlite indicator minerals, northern Superior area.

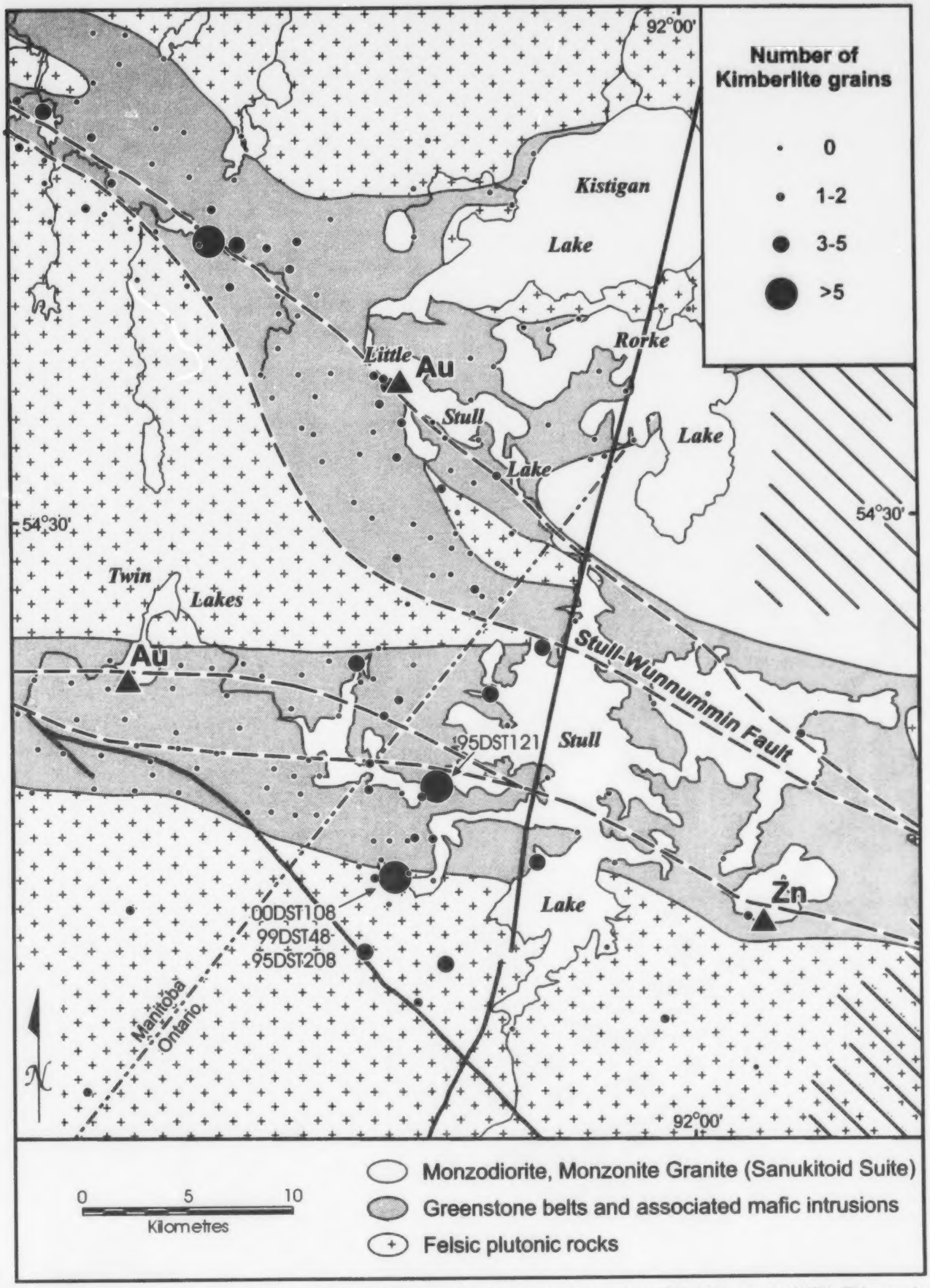
92°00'
Number of Kimberlite grains
0
1-2
3-5
>5
Kistigan
Lake
Rorke
Lake
Little
Au
Stull
Lake
54°30'
54°30'
Twin
Lakes
Au
Stull-Wunnummin Fault
Stull
95DST121
Lake
Zn
00DST108
99DST48
95DST208
Manitoba
Ontario
N
92°00'
0
5
10
Kilometres
Monzodiorite, Monzonite Granite (Sanukitoid Suite)
Greenstone belts and associated mafic intrusions
Felsic plutonic rocks

Figure 10: Distribution of kimberlite indicator minerals, Stull Lake area including data of Fedikow *et al.* (1998). This area is shown as the detail area in **Figure 9**.

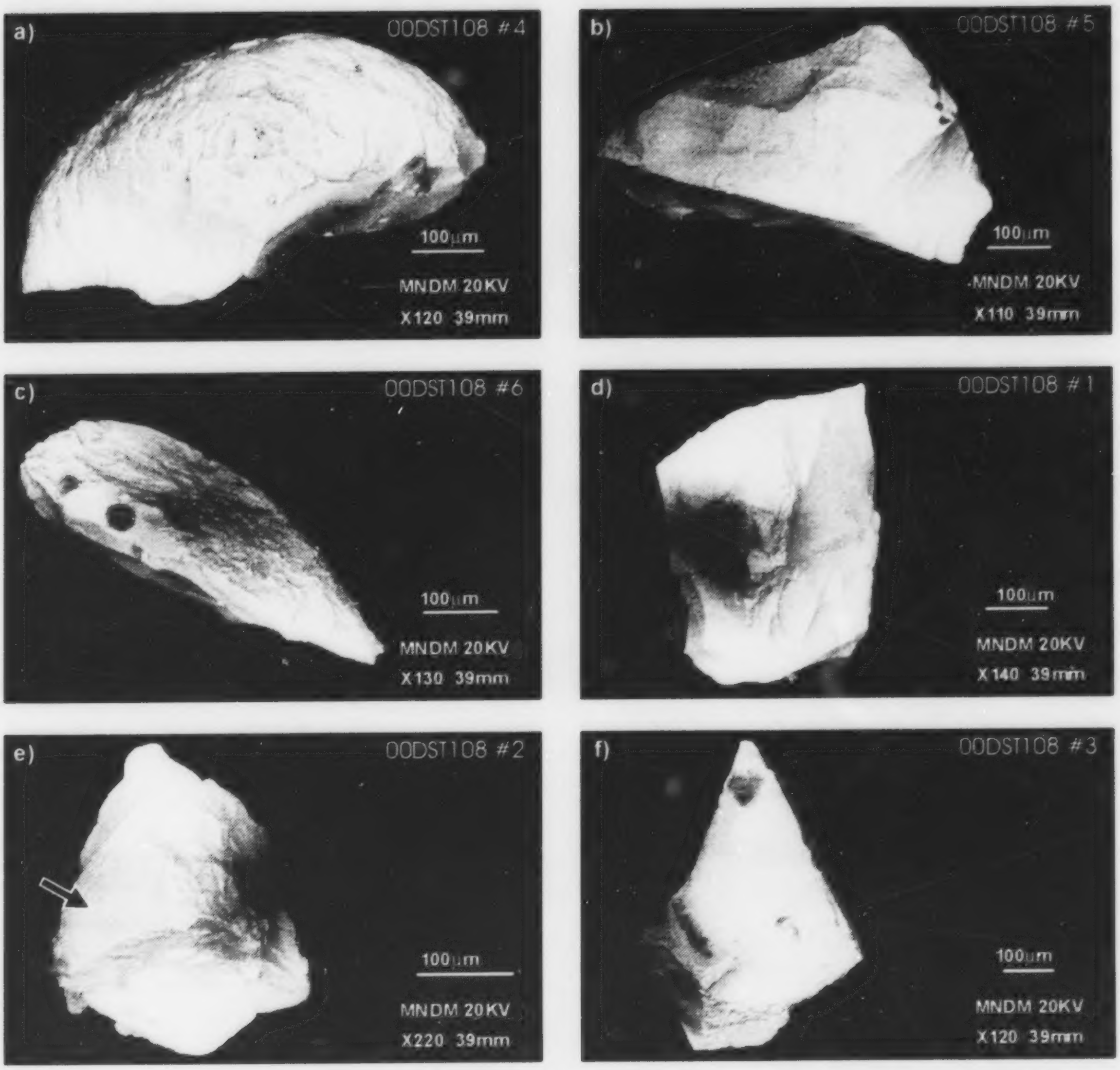
a)
00DST108 #4
100µm
MNDM 20KV
X120 39mm
b)
00DST108 #5
100µm
MNDM 20KV
X110 39mm
c)
00DST108 #6
100µm
MNDM 20KV
X130 39mm
d)
00DST108 #1
100µm
MNDM 20KV
X140 39mm
e)
00DST108 #2
100µm
MNDM 20KV
X220 39mm
f)
00DST108 #3
100µm
MNDM 20KV
X120 39mm

Figure 11: Scanning electron microscope images of selected Cr-pyrope grains in sample 00DST108 from western Stull Lake. See text for details.

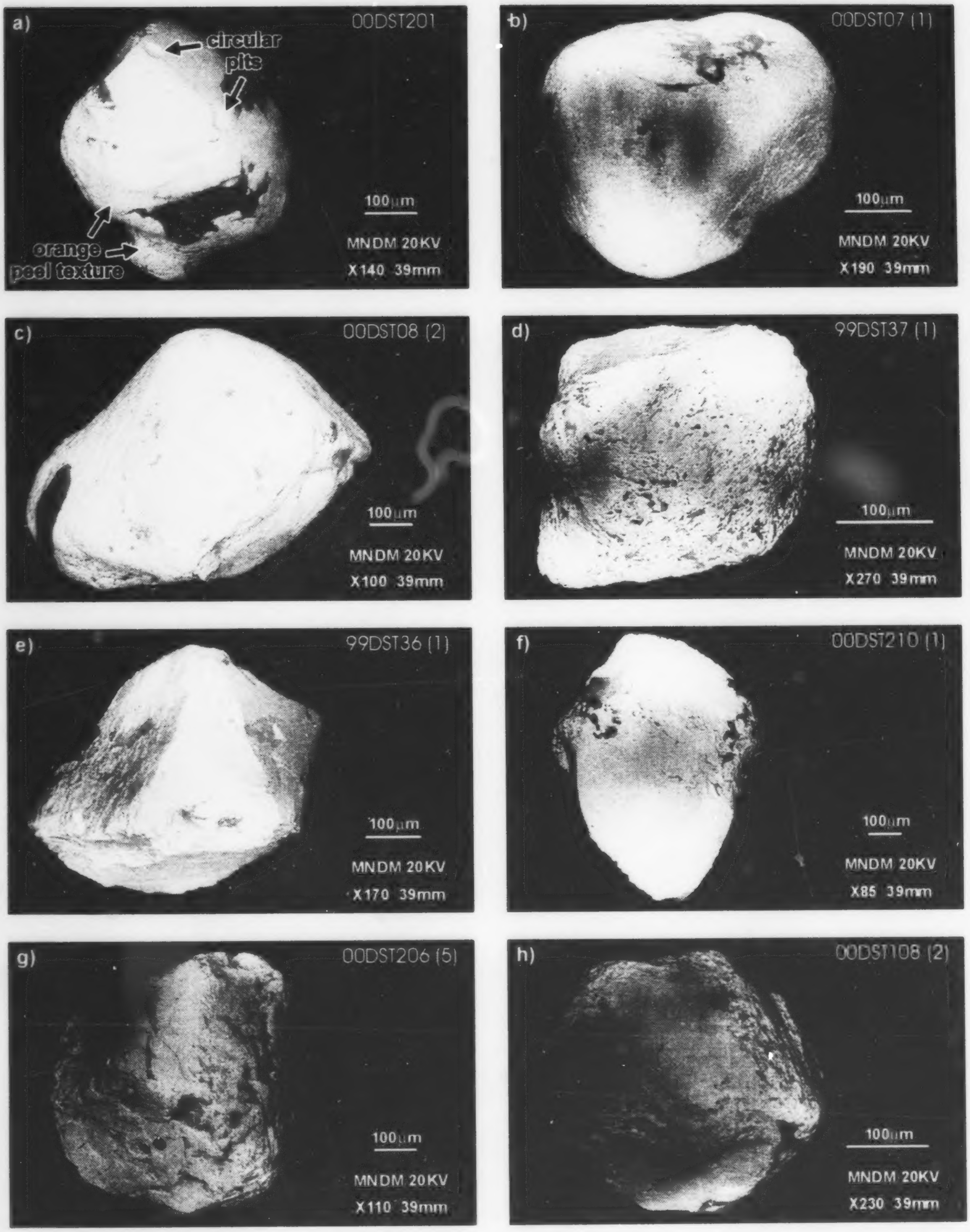
a)
00DST201
circular pits
orange peel texture
100µm
MNDM 20KV
X140 39mm
b)
00DST07 (1)
100µm
MNDM 20KV
X190 39mm
c)
00DST08 (2)
100µm
MNDM 20KV
X100 39mm
d)
99DST37 (1)
100µm
MNDM 20KV
X270 39mm
e)
99DST36 (1)
100µm
MNDM 20KV
X170 39mm
f)
00DST210 (1)
100µm
MNDM 20KV
X85 39mm
g)
00DST206 (5)
100µm
MNDM 20KV
X110 39mm
h)
00DST108 (2)
100µm
MNDM 20KV
X230 39mm

Figure 12: Scanning electron microscope images of selected chromite grains from east and west of the Sachigo moraine.

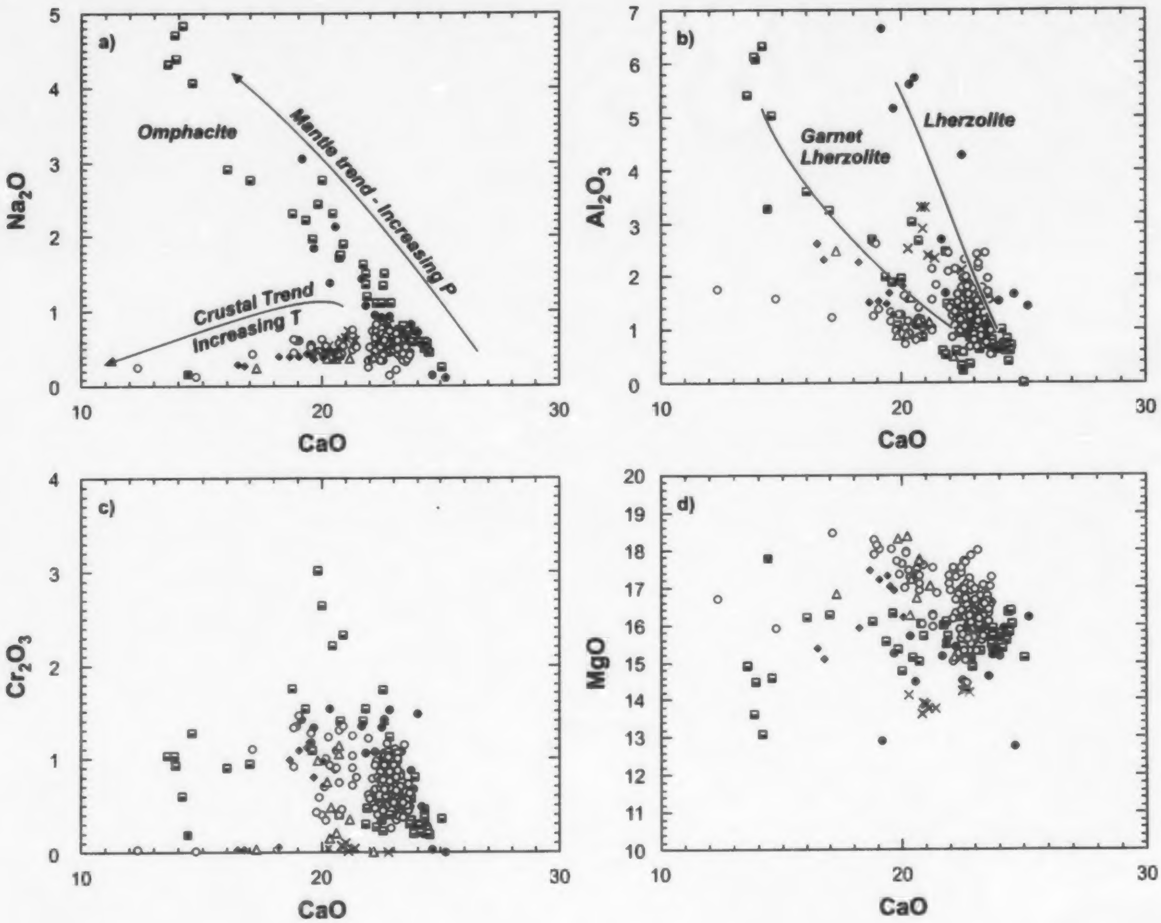

Figure 13: (a to g) Variations in selected major oxides with CaO in clinopyroxenes of the northern Superior area. See **Figure 8** for symbols.

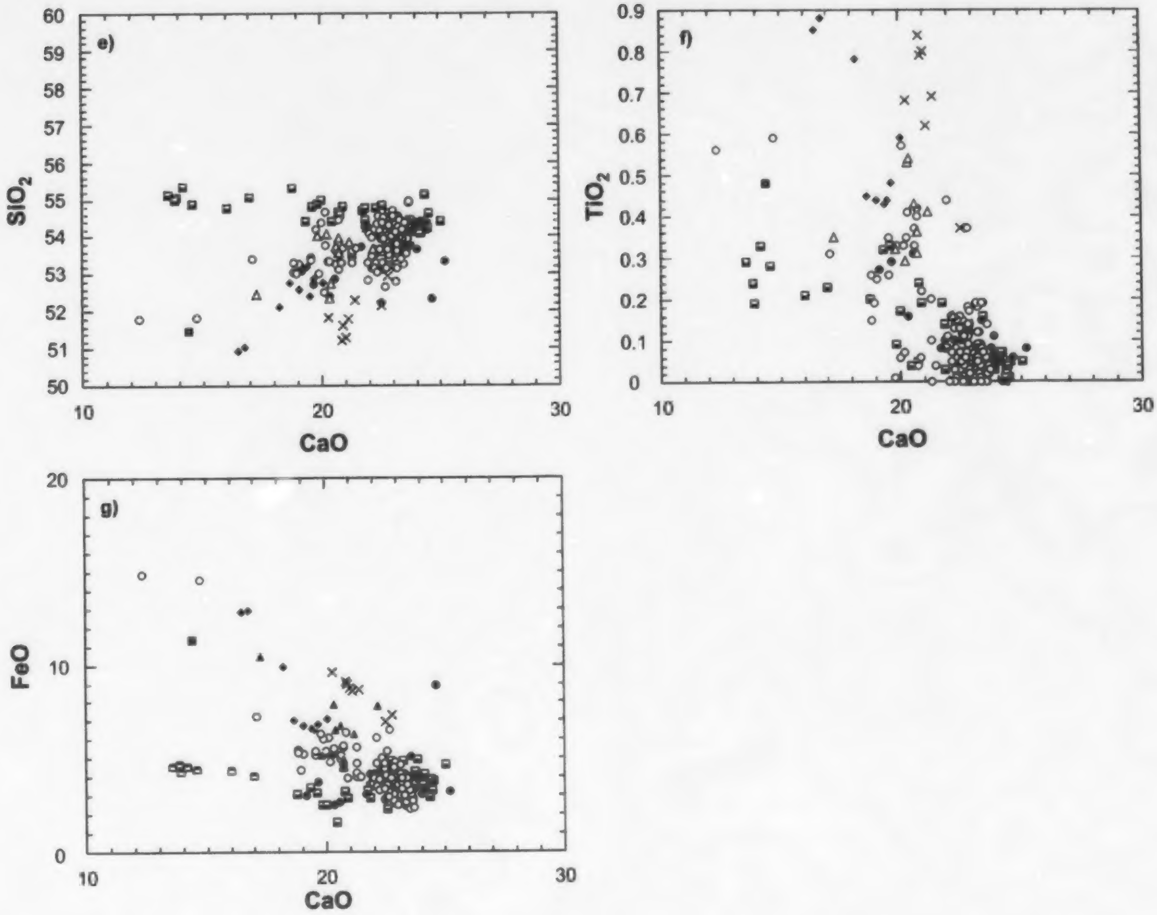

Figure 13 (con't): (a to g) Variations in selected major oxides with CaO in clinopyroxenes of the northern Superior area. See **Figure 8** for symbols.

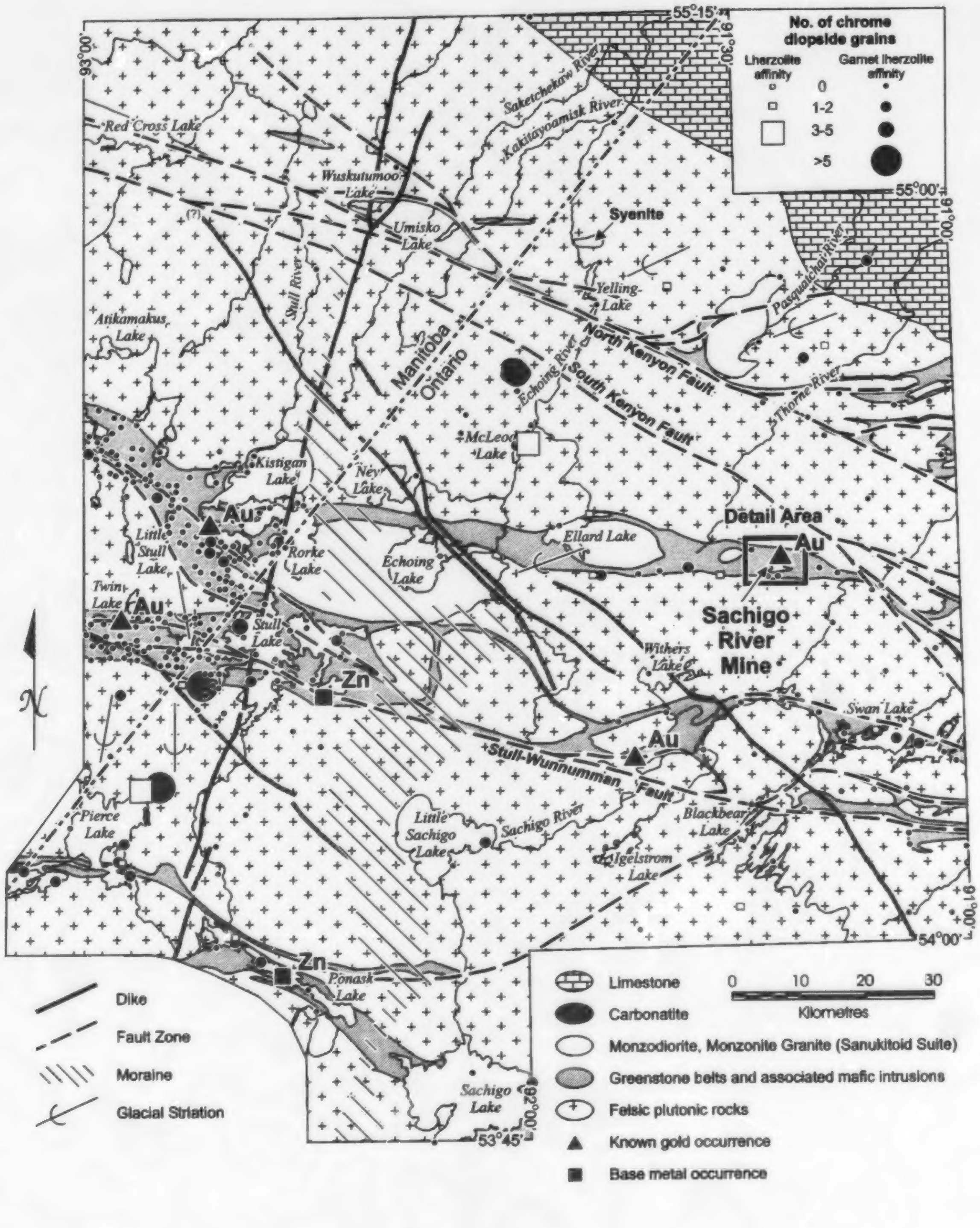
No. of chrome diopside grains
Lherzolite affinity
Garnet lherzolite affinity
0
1-2
3-5
>5
55°15'
55°00'
54°00'
53°45'
93°00'
91°30'
91°00'
92°00'
Red Cross Lake
Saketchekaw River
Kakitayoamisk River
Wuskutumoo Lake
Umisko Lake
Syenite
Yelling Lake
Pasquatchai River
Stull River
Atikamakus Lake
Manitoba
Ontario
Echoing River
North Kenyon Fault
South Kenyon Fault
Thorne River
McLeod Lake
Kistigan Lake
Ney Lake
Au
Little Stull Lake
Rorke Lake
Echoing Lake
Ellard Lake
Detail Area
Twin Lake
Stull Lake
Zn
Sachigo River Mine
Withers Lake
Swan Lake
Stull-Wunnummin Fault
Pierce Lake
Little Sachigo Lake
Sachigo River
Blackbear Lake
Ugelstrom Lake
Ponask Lake
Sachigo Lake
N
Dike
Fault Zone
Moraine
Glacial Striation
Limestone
Carbonatite
Monzodiorite, Monzonite Granite (Sanukitoid Suite)
Greenstone belts and associated mafic intrusions
Felsic plutonic rocks
Known gold occurrence
Base metal occurrence
0
10
20
30
Kilometres

Figure 14: Distribution of Cr-diopside grains, northern Superior area.

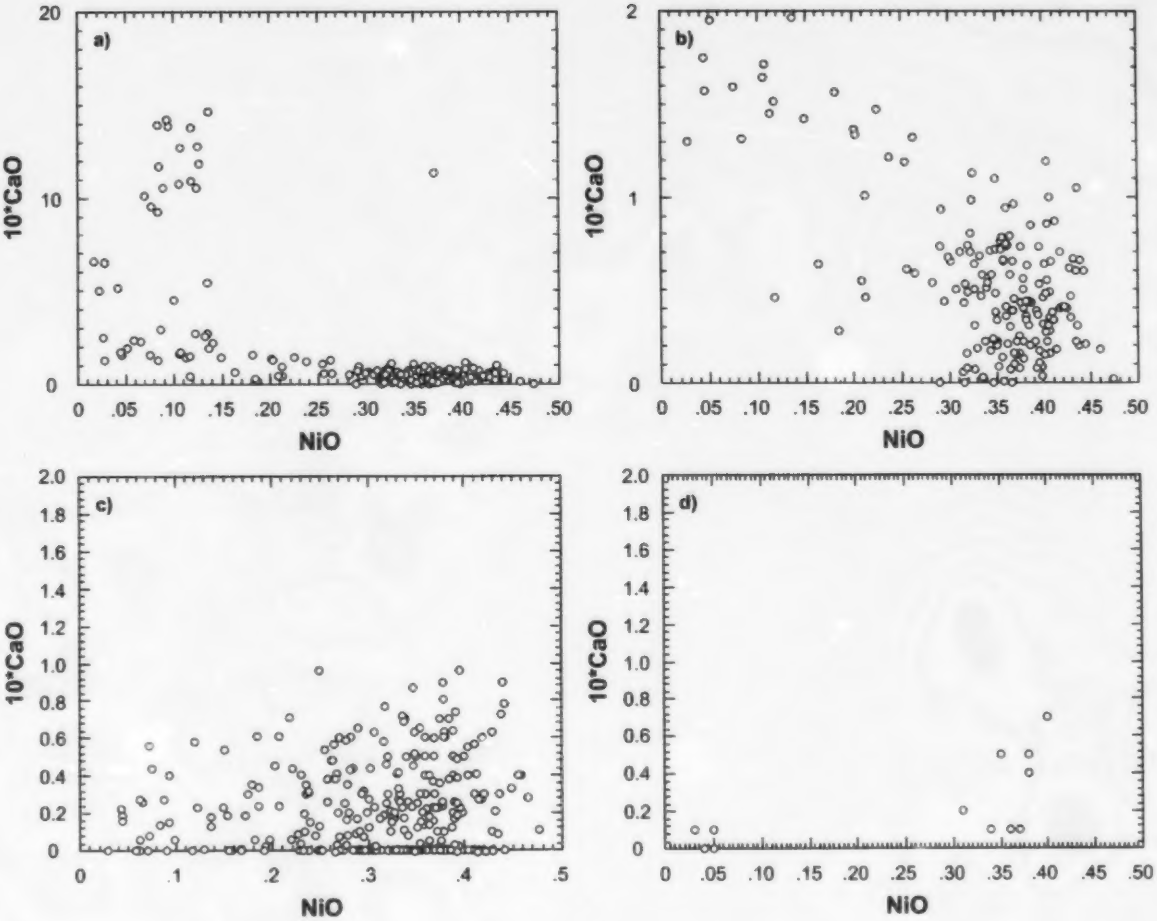

Figure 15: CaO-NiO variations of olivine. **(a)** kimberlites of the Kirkland Lake area (data of Sage 1996, 2000a); **(b)** enlargement of part of **(a)**; **(c)** kimberlites of the Attawapiskat area (data of Sage 2000b) and **(d)** surficial materials of the northern Superior area.

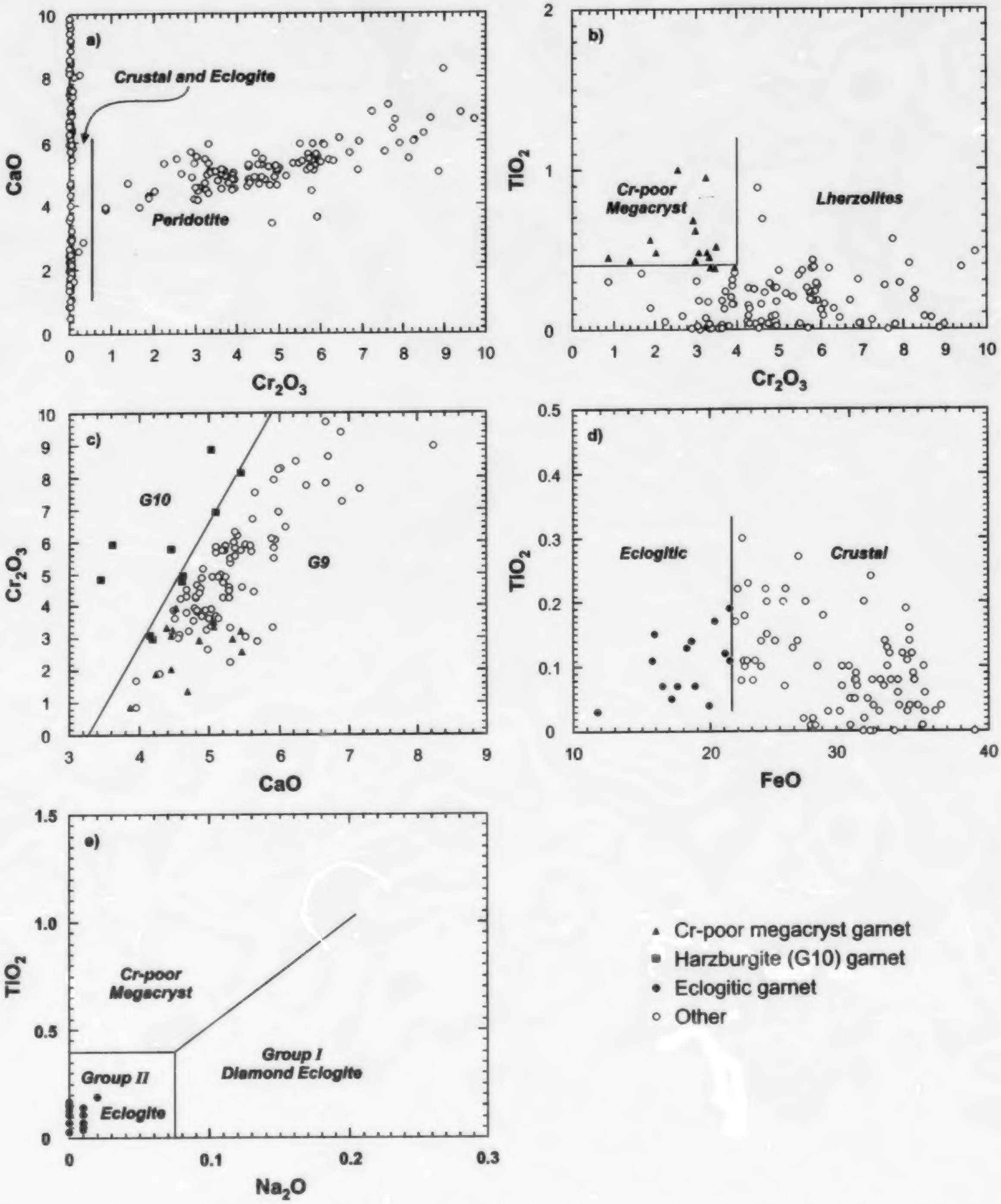

Figure 16: Garnets of the northern Superior area. **(a)** CaO-Cr$_2$O$_3$ variations for discrimination of crustal and eclogitic garnets from peridotitic garnets (after Schultze (1997); **(b)** TiO$_2$-Cr$_2$O$_3$ variations for distintion of Cr-poor megacrystic garnets from lherzolitic garnets; **(c)** Cr$_2$O$_3$-CaO variations for separation of harzburgitic (G10) garnets from lherzolitic (G9) garnets; **(d)** TiO$_2$-FeO diagram for eclogitic and crustal garnets; **(e)** TiO$_2$-Na$_2$O diagram for eclogitic garnets.

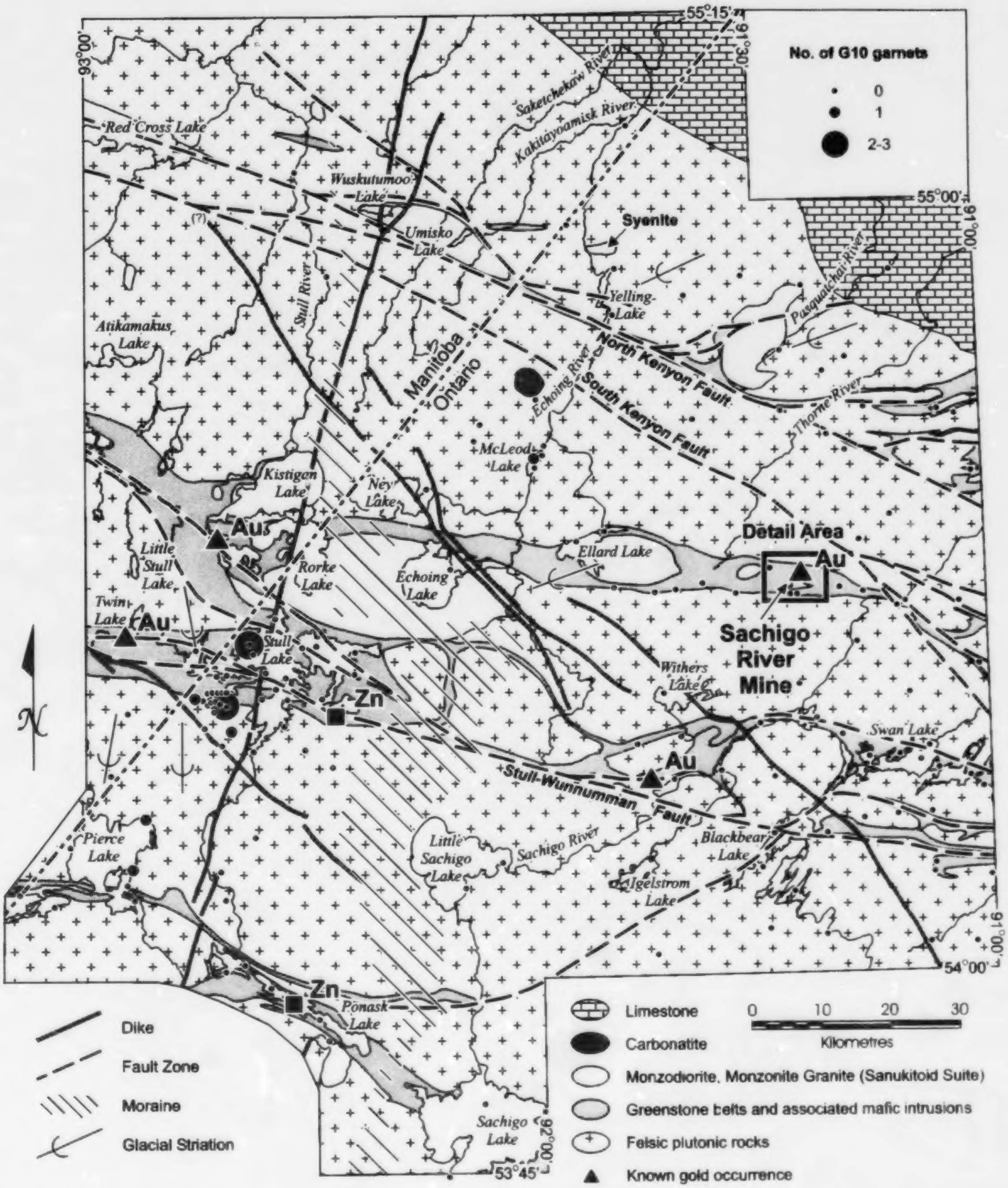
No. of G10 garnets
0
1
2-3
55°15'
55°00'
54°00'
53°45'
93°00'
92°00'
91°30'
91°00'
Red Cross Lake
Wuskutumoo Lake
Umisko Lake
Saketchekaw River
Kakitayoamisk River
Syenite
Yelling Lake
Pasquatchai River
Atikamakus Lake
Stull River
Manitoba
Ontario
Echoing River
North Kenyon Fault
South Kenyon Fault
Thorne River
McLeod Lake
Kistigan Lake
Ney Lake
Au
Detail Area
Ellard Lake
Little Stull Lake
Rorke Lake
Echoing Lake
Twin Lake
Stull Lake
Sachigo River Mine
Withers Lake
Zn
Swan Lake
Stull-Wunnumman Fault
Pierce Lake
Little Sachigo Lake
Sachigo River
Blackbear Lake
Igelstrom Lake
Ponask Lake
Sachigo Lake
N
Dike
Fault Zone
Moraine
Glacial Striation
Limestone
Carbonatite
Monzodiorite, Monzonite Granite (Sanukitoid Suite)
Greenstone belts and associated mafic intrusions
Felsic plutonic rocks
Known gold occurrence
Base metal occurrence
0
10
20
30
Kilometres

Figure 17: Distribution of G10 garnets, northern Superior area.

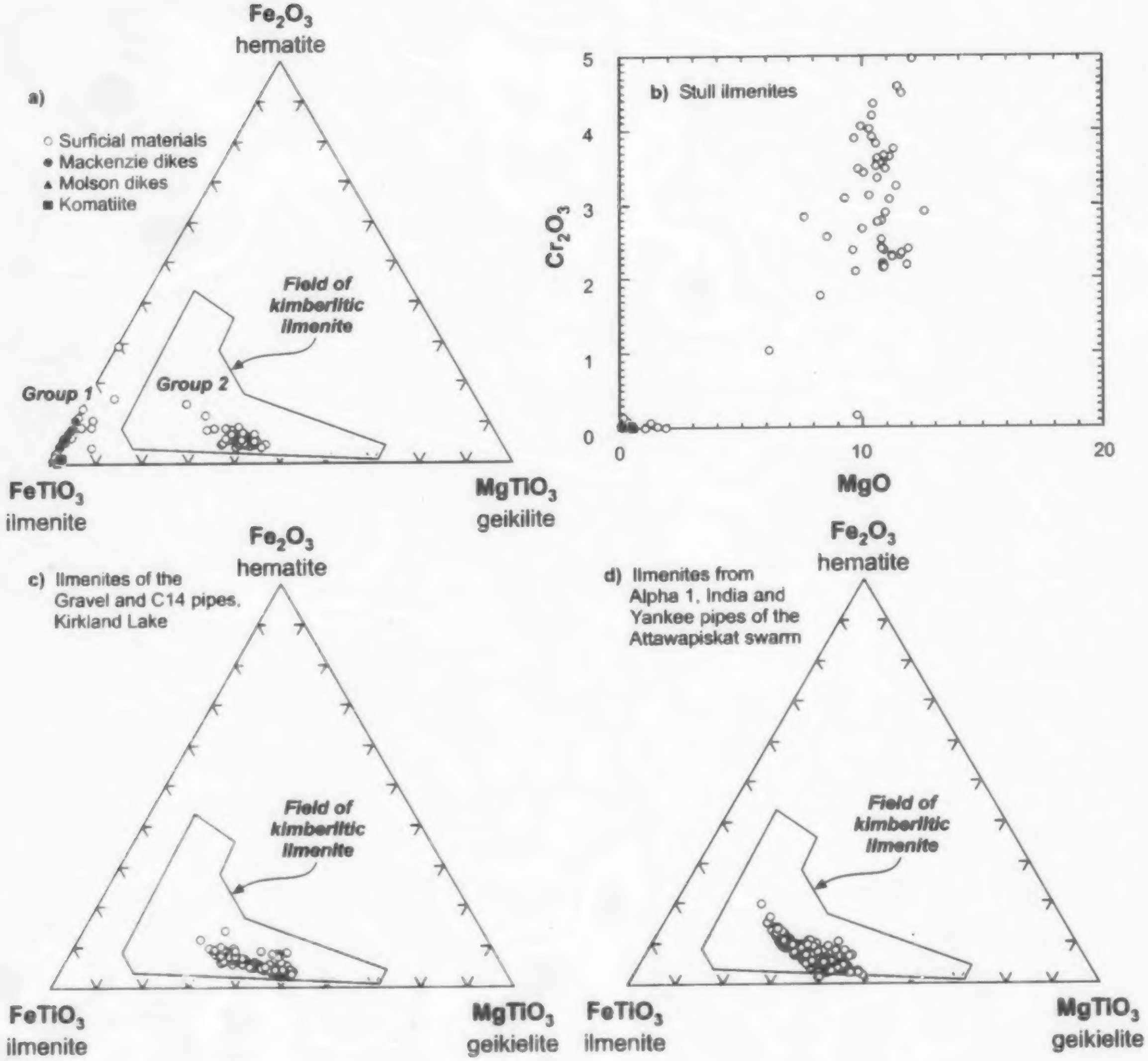

Figure 18: **(a)** Ilmenite compositions from the northern Superior area shown in terms of ilmenite-hematite-geikielite end-members. Group 1 and Group 2 are discussed in the text. Field of kimberlitic ilmenite is from Haggerty and Tompkins (1983). **(b)** Cr_2O_3-MgO relations of northern Superior ilmenites. **(c)** compositions of ilmenites from the Gravel and C14 pipes of the Kirkland Lake area (data of Sage, 1996, 2000a). **(d)** compositions of ilmenites from the Alpha 1, India and Yankee pipes of the Attawapiskat area (data of Sage, 2000b).

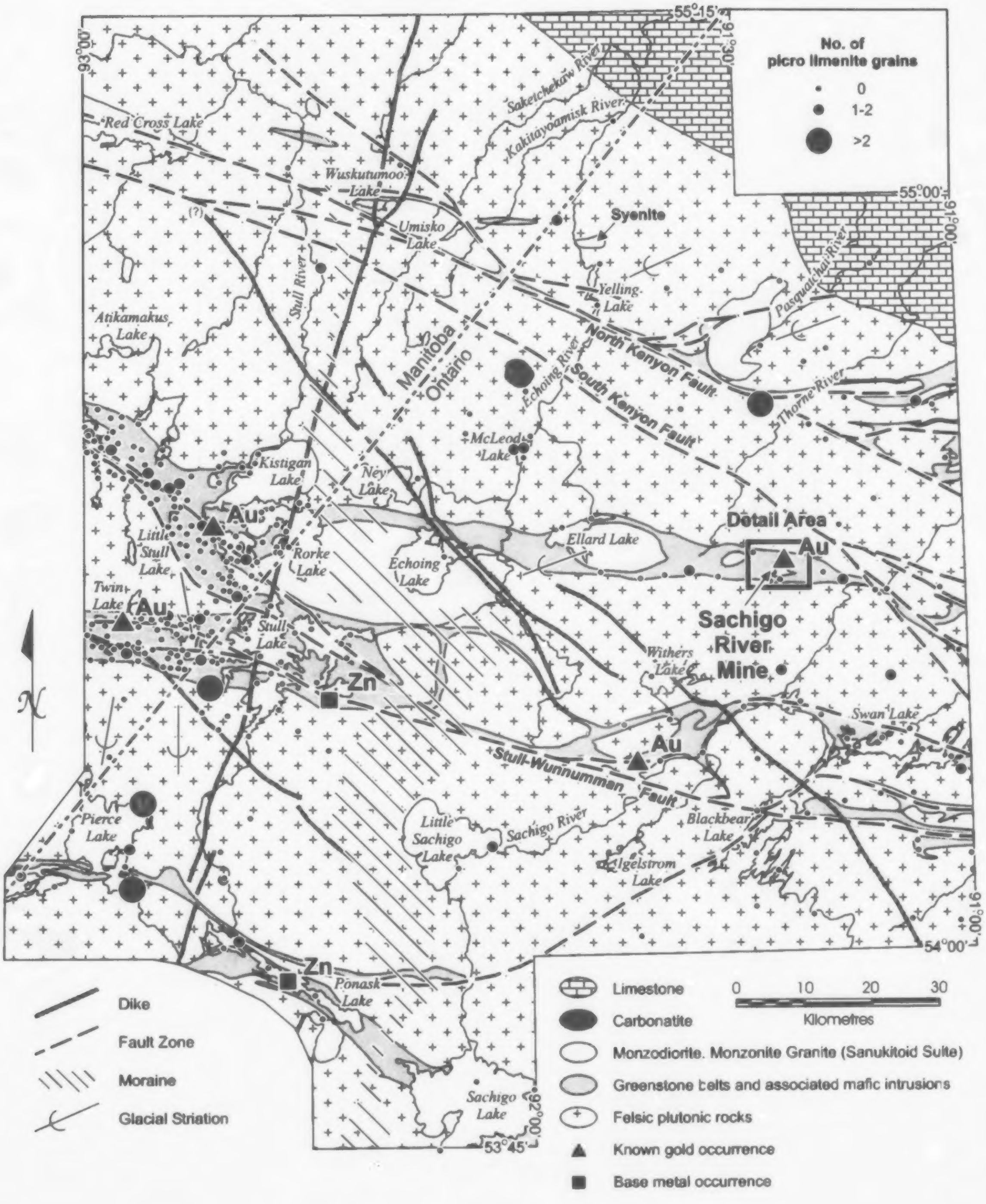
No. of picro ilmenite grains
0
1-2
>2
55°15'
55°00'
54°00'
53°45'
93°00'
91°30'
91°00'
92°00'
Red Cross Lake
Wuskutumoo Lake
Umisko Lake
Saketchekaw River
Kakitayoamisk River
Syenite
Stull River
Yelling Lake
Pasquatchai River
Atikamakus Lake
Manitoba
Ontario
Echoing River
North Kenyon Fault
South Kenyon Fault
Thorne River
McLeod Lake
Kistigan Lake
Ney Lake
Au
Little Stull Lake
Rorke Lake
Echoing Lake
Ellard Lake
Detail Area
Twin Lake
Stull Lake
Sachigo River Mine
Withers Lake
Zn
Swan Lake
Stull-Wunnumman Fault
Pierce Lake
Little Sachigo Lake
Sachigo River
Blackbear Lake
Ilgelstrom Lake
Ponask Lake
Sachigo Lake
N
Dike
Fault Zone
Moraine
Glacial Striation
Limestone
Carbonatite
Monzodiorite. Monzonite Granite (Sanukitoid Suite)
Greenstone belts and associated mafic intrusions
Felsic plutonic rocks
Known gold occurrence
Base metal occurrence
0
10
20
30
Kilometres

Figure 19: Distribution of picro-ilmenite, northern Superior area.

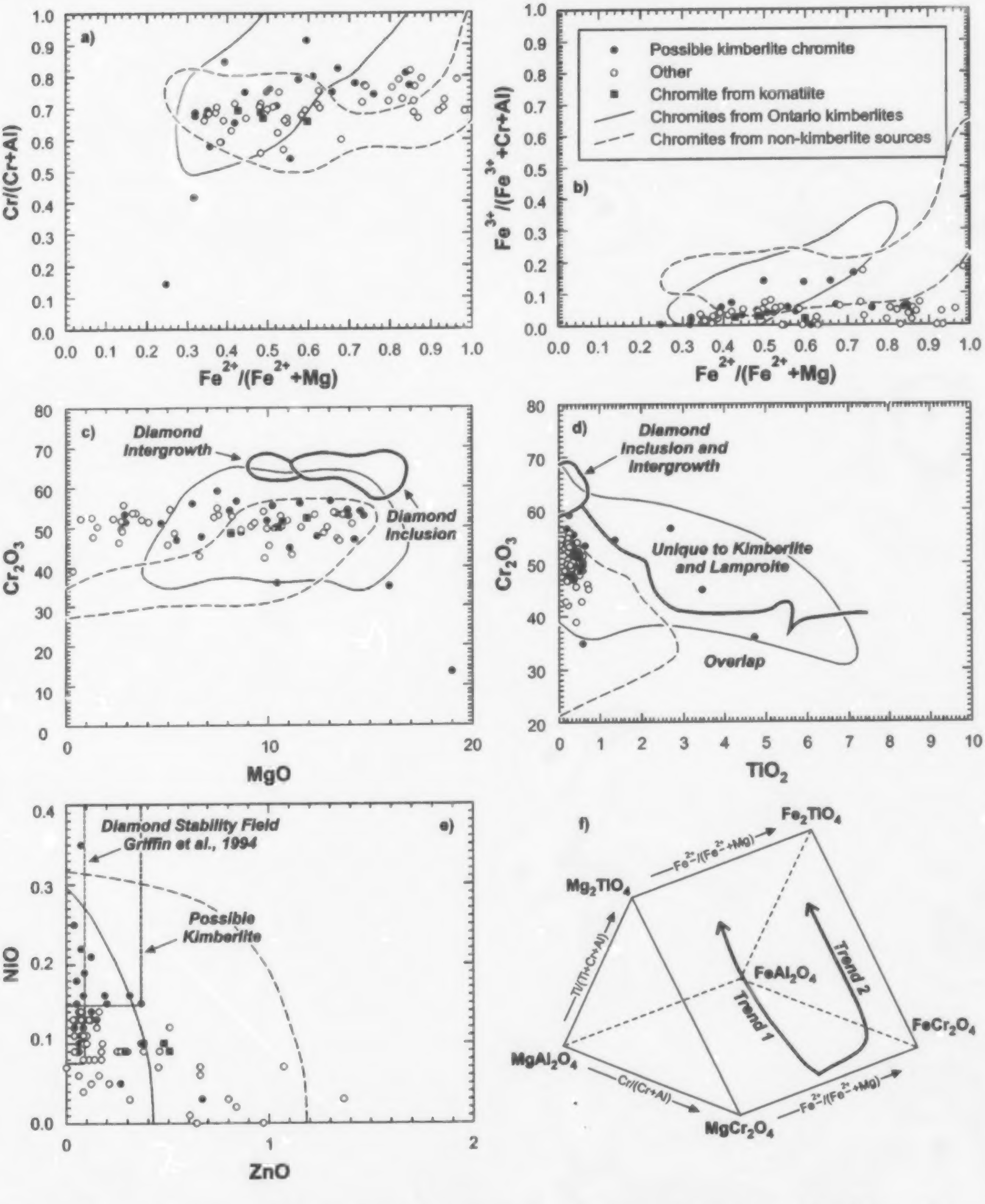

Figure 20: Compositions of chromites from the northern Superior area. **(a)** Cr/(Cr+Al)-Fe^{2+}/(Fe^{2+}+Mg) relations; **(b)** Fe^{3+}/(Fe^{3+}+Cr+Al)-Fe^{2+}/(Fe^{2+}+Mg) relations; **(c)** Cr_2O_3-MgO relations; **(d)** Cr_2O_3-TiO_2 relations; **(e)** NiO-ZnO relations. Field of chromites from Ontario kimberlites is defined using data of Sage (1996, 2000a,b). Field of non-kimberlitic chromites is defined using data of Watkinson and Mainwaring (1982). Fields of diamond intergrowth, diamond inclusion, unique to kimberlite and laproite and overlap are from Fipke *et al.* (1995). Diamond stability field in **(e)** is from Griffin *et al.* (1994). Spinel prism **(f)** is from Mitchell (1986).

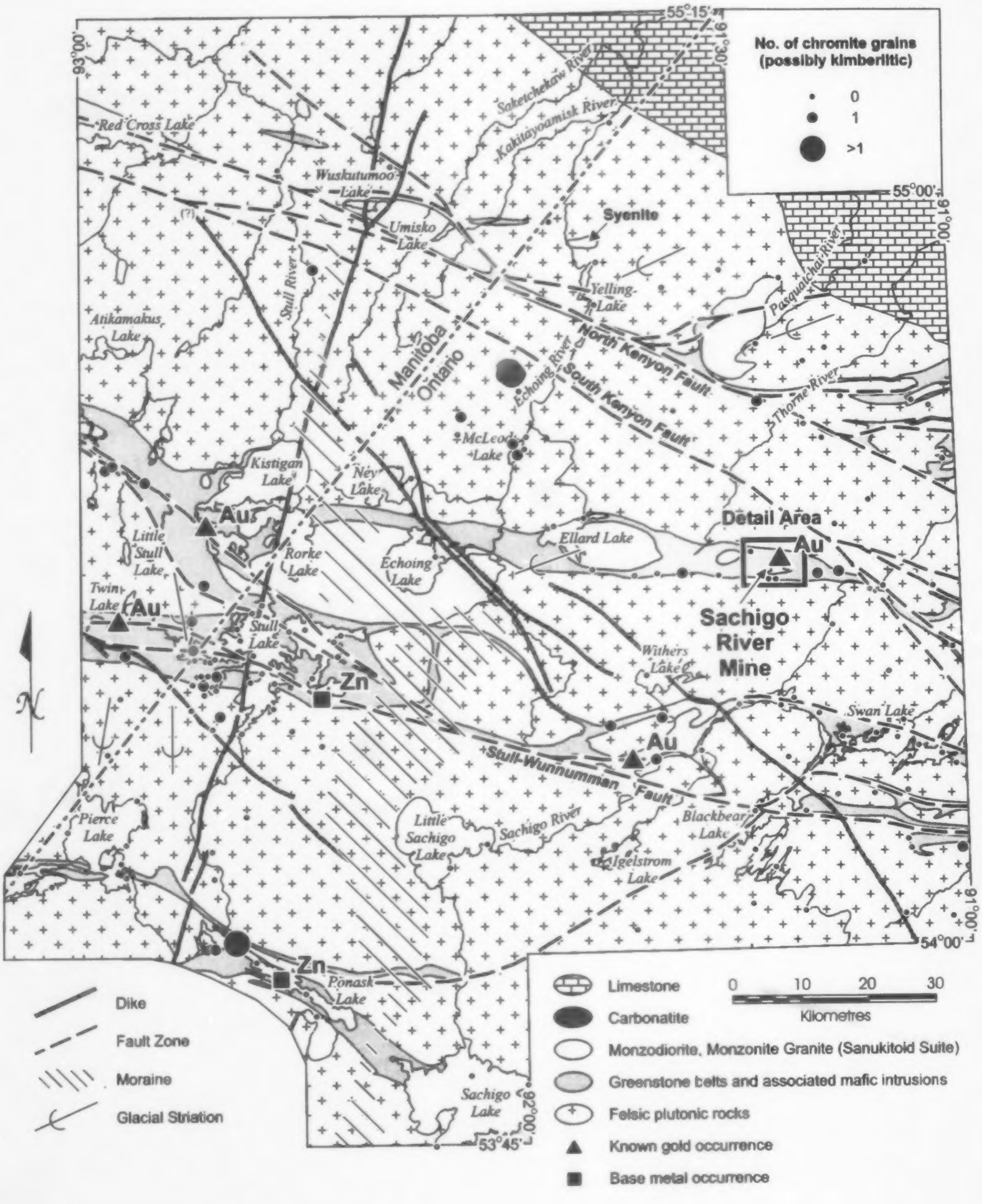
No. of chromite grains (possibly kimberlitic)
0
1
>1
55°15'
91°30'
55°00'
91°00'
93°00'
54°00'
92°00'
53°45'
Red Cross Lake
Wuskutumoo Lake
Umisko Lake
Saketchekaw River
Kakitayoamisk River
Syenite
Yelling Lake
Pasquatchai River
Atikamakus Lake
Stull River
Manitoba
Ontario
Echoing River
North Kenyon Fault
South Kenyon Fault
Thorne River
McLeod Lake
Kistigan Lake
Ney Lake
Au
Little Stull Lake
Rorke Lake
Echoing Lake
Ellard Lake
Detail Area
Au
Sachigo River Mine
Twin Lake
Au
Stull Lake
Zn
Withers Lake
Swan Lake
N
Au
Stull-Wunnumman Fault
Pierce Lake
Little Sachigo Lake
Sachigo River
Blackbear Lake
Igelstrom Lake
Zn
Ponask Lake
Sachigo Lake
(?)
Dike
Fault Zone
Moraine
Glacial Striation
Limestone
Carbonatite
Monzodiorite, Monzonite Granite (Sanukitoid Suite)
Greenstone belts and associated mafic intrusions
Felsic plutonic rocks
Known gold occurrence
Base metal occurrence
0
10
20
30
Kilometres

Figure 21: Distribution of chromite, northern Superior area.

Table 1: Location and description of northern Superior samples, 1995-2000

* indicates a duplicate sample taken in 1997 at the site of a 1995 sample

Sample No	Area	UTM east	UTM north	Description of sampled material
95DST022	Central Stull L	525500	6027700	blue/grey carbonate-rich till at .5 to .6 m depth on bedrock
95DST023	Rapson Bay	530700	6031300	beach sand between cobbles
95DST024	Rapson Bay	533600	6031800	medium to coarse beach sand overlying glaciolacustrine clay
95DST024b*	Rapson Bay	533600	6031800	medium-coarse grained beach sand overlaying glacio-lacustrine clay
95DST025	E Rapson Bay	537600	6029950	beach sand
95DST025b*	Rapson Bay	536700	6029950	beach sand
95DST026	E Rapson Bay	538100	6027850	beach sand
95DST027	E Central Stull	527900	6027450	beach sand
95DST028	S Stull	528500	6019500	beach sand
95DST029	Stull Campsite	527000	6025200	blue-grey clay-till? beneath beach on bedrock, .6 m depth
95DST030	S Stull L	523950	6016000	beach sand
95DST030*	Stull L	523950	6016000	beach sand
95DST120	Stull	524300	6030200	fine to coarse beach sand on outcrop
95DST120b*	Stull L	524300	6030200	coarse Sand/Gravel on bedrock among boulders
95DST121	Stull L., entrance to Monument Bay	520200	6027500	sand with cobbles at waters edge
95DST121*	SW Stull	520200	6027400	carbonate-rich pebbly till at water's edge
95DST122	N Pierce Lake	503800	6013200	sand with cobbles under 10 cm water
95DST123	Monument Bay	515900	6030600	silty sand from sand spit
95DST204	Rapson Bay S	534100	6023300	medium beach sand .2 to .3 m depth
95DST205	SE Stull Lake	528850	6023800	beach sand
95DST206	NE Rapson Bay	538000	6030900	beach sand
95DST207	S-Central Stull	524800	6023800	beach sand
95DST207*	Stull L	524800	6023800	beach sand
95DST208	W Richardson Arm	518200	6023600	beach sand overlain by .3 m of clay and humus
95DST208*	SW Stull	518200	6023600	beach sand overlain by .3 m of clay and humus. Fine sand at water's edge in a cut bank
95DST209	N Stull	525500	6034500	beach sand
95DST209b*	Stull L	526300	6034000	beach sand
95DST210	N Stull	527500	6035500	beach sand
96DST01	West Ponask L	519700	5984700	coarse grit among boulders on bedrock at shoreline
96DST02	McHenry Lake	520300	5994900	beach sand among boulders on bedrock at shoreline
96DST03	Ponask Lake	522200	5986000	coarse grit among boulders on bedrock at shoreline
96DST04	Sachigo Lake	565350	5957150	beach sand
96DST05	Sachigo Lake	564750	5965450	beach sand
96DST100	Ponask Lake	533000	5978100	beach sand among boulders on bedrock at shoreline
96DST101	Sachigo Lake	551800	5955400	beach sand
96DST102	Little Sachigo Lake	559900	5999700	beach sand
96DST103	Little Sachigo Lake	554200	5996500	beach sand
96DST201	Ponask Lake	526500	5982300	beach sand, central Ponask south shore
96DST202	Ponask Lake	528300	5981100	beach sand, central Ponask Lake
96DST203	Angicum Bay, Ponask	534100	5975000	beach sand
97DST01	W Pierce L	490500	5996100	coarse sand among boulders on greenstone bedrock at wavebase
97DST02	SW Pierce L	495700	5994200	beach sand

Sample No	Area	UTM east	UTM north	Description of sampled material
97DST03	Yelling L	575800	6079900	beach on flank of esker
97DST04	Rieder L	576200	6085500	coarse grit on bedrock at wavebase
97DST05	W Stull L	523200	6031800	beach sand
97DST06	NW of Yelling L	569100	6092900	weathered till on bedrock
97DST07	Little Stull L	518500	6046000	blue silty till on bedrock at Westmin gold trench
97DST08	E of Yelling L	586600	6082200	red weathered silty till on bedrock
97DST09	E of Yelling L	595900	6084600	tan silty till on bedrock 0.1 to 0.5m depth
97DST100	Pierce L	506000	5997050	beach sand
97DST101	Pierce L	506900	5994900	beach sand
97DST102	Pierce L	506200	5999400	beach sand
97DST103	Pierce L	508100	6006600	beach sand
97DST104	Pierce L	498100	6002300	beach sand
97DST105	McLeod Lake, west shore	565500	6058500	beach sand
97DST106	E Echoing L	552300	6042300	beach sand
97DST107	E Ney L	548800	6054300	beach sand
97DST108	SW of Carb L	557200	6063300	esker sand
97DST109	SW of Carb L	556200	6060600	esker gravel and sand
97DST110	S of Twin L	505800	6021600	beach sand
98DST01	Ellard Lake	570784	6046657	beach sand
98DST02	Corking L	607800	6040400	beach developed on drumlin
98DST03	NE Ellard	587700	6064000	coarse sand among boulders on shoreline
98DST04	Pasquatchi R	599600	6065000	red weathered till on bedrock
98DST05	Shallow L	607200	6071400	red weathered till on bedrock
98DST06	W Shallow L	600600	6074700	red weathered till in bedrock crevasse
98DST07	N of Dodson L	622100	6065800	grey-red weathered unconsolidated till on bedrock
98DST08	NW Shallow L	603500	6083600	red silty till on bedrock
98DST100	Gummer L	581120	6038747	beach sand
98DST101	Lacey L	583824	6039192	beach sand
98DST102	W Sellen L	588200	6040000	river sand
98DST105	S Chick L	592500	6039100	river sand
98DST300	Mooreson L	576261	6039503	beach sand
98DST301	N Ellard L	574440	6047257	beach sand
98DST302	Schmidt L	611100	6039600	beach sand
98DST303	E Shallow L	607202	6071400	beach sand
98DST304	NE of Shallow L	616000	6085700	beach sand
99DST02	E. Tamblyn	602440	6025780	sand with boulders at beach developed on edge of drumlin, 10% carbonate pebbles
99DST03	Sherman L	601450	6039600	tan brown silty till (1m) over .1m red sand on bedrock
99DST04	Sherman L	601000	6039000	tan brown silty till (3m) on bedrock beneath muskeg
99DST05	W. Sherman	598400	6038200	tan silty till, 1m depth on flank of drumlin
99DST06	W. Sherman	599100	6038500	silty till, .5m deep on flank of drumlin
99DST07	W. Sherman	598800	6038900	pebbly silty till, 1m depth beneath .4m peat
99DST08	W. Sherman	599700	6038800	tan silty till beneath muskeg
99DST09	W. Sherman	598950	6039600	two layers of tan silty till separated by .1m organic horizon (.4m and .7m depth) on bedrock
99DST10	W. Sherman	599700	6039400	tan silty till .6m in dry muskeg

Sample No	Area	UTM east	UTM north	Description of sampled material
99DST11	W. Sherman	600700	6038600	red sandy horizon in grey silt on berock, .5m depth
99DST12	W. Sherman	600200	6039250	silty till, tan brown, 1m depth below .3m, peat in dry muskeg on drumlin. Ls, gs & granite cobbles observed
99DST13	W. Sherman	600600	6040100	tan silty till .7m near crest of drumlin
99DST14	W. Sherman	600200	6040300	grey limey beach deposit 30cm under water among boulders in small lake
99DST15	W. Sherman	599550	6040400	tan silty till 1m at down ice end of drumlin
99DST17	NW Sherman	600500	6041200	tan silty till .5m beneath .2m red oxidized layer, well-drained at nose of drumlin
99DST18	W. Sherman	600850	6040800	tan pebbly till with brown oxidized zones .6m in dry muskeg with boulders
99DST19	Sherman L	602950	6040400	silty grey beach deposit 30cm below water on greenstone bedrock
99DST20	N. Sherman	603300	6041000	red silt with gritty horizon 2cm above bedrock .4m depth, mostly greenstone clasts
99DST21	N. Sherman	603100	6040950	red-grey gritty silt in bedrock crevasse .3m depth; pebbles of GS, granite, LS
99DST22	N. Sherman	602700	6040900	black gritty horizon .8m depth at interface of overlying peat with underlying silt? GS, diorite, LS, GR clasts
99DST23	Foster L	602800	6041100	red sandy grit on diorite .3m depth
99DST24	Foster L	602400	6041100	red sandy grit on diorite beneath muskeg .4m
99DST25	N. Sherman	602400	6040900	grey silty till .8m on bedrock or large boulder beneath .5m black muskeg, mix of volcanic, LS, diorite clasts
99DST26	Foster L	603050	6041500	red oxidized till on bedrock in crevasse beneath overturned tree, .3m
99DST27	S. Foster L	603050	6041200	red weathered till on bedrock in crevasse .4m depth
99DST28	Sherman L	602150	6040500	very silty lake sediments behind outcrop .6m + 2 scoops sand from lake 30cm depth
99DST29	E. Foster	603500	6041500	red gritty till in bedrock crevasse beneath overturned root, .6m
99DST30	E. Foster	603700	6041700	grey, silty till beneath .4m peat near outcrop .5 to 1m depth (2 pits) LS and greenstone clasts
99DST31	E. Foster	603300	6041650	coarse grit in narrow bedrock crevasse .8m beneath grey till and organics
99DST32	S. Dadson	627400	6056600	red weathered till on bedrock .2m
99DST33	N. Schmidt	615400	6050200	red weathered till on bedrock .2m
99DST34	Far N. of Sherman L	612600	6065800	red weathered till beneath tree root on bedrock .2m
99DST35	Far N. of Sherman	606600	6062100	red weathered till on bedrock .2m
99DST36	SW Meston	579500	6017700	red weathered till on bedrock .2m
99DST37	N. Igelstrom	582200	6012000	red weathered till beneath tree root on bedrock .2m
99DST38	Far N. of Sherman	608800	6059800	red weathered till on bedrock .2m
99DST39	E. of Schmidt	627000	6037700	red weathered till .2m
99DST40	S. Stull	535200	6015200	silty till beneath tree root on boulders
99DST41	S. Stull	518100	6021400	red pebbly till on bedrock .4m
99DST42	S. Stull	516900	6018300	grey silt with a little grit on bedrock .2m
99DST43	S. Stull	519700	6016900	very silty grey till on bedrock (granite pegmatite)
99DST44	S. Stull	520900	6019500	red silty till .3m
99DST45	S. Stull	530600	6016600	grey silty beach deposit among boulders .2m below water
99DST46	S. Stull	524300	6003800	red gritty till on granite bedrock .3m
99DST47	S. Stull	519100	598700	grey silty till on pink granite
99DST48	Richardson Arm	518000	6023500	beach sand
99DST49	Richardson Arm	519100	6023300	beach sand
99DST50	Richardson Arm	520000	6022800	beach sand
99DST100	W. Withers	583549	6024299	sand & gravel off tonalite outcrop, west of NE trending esker
99DST101	E. Meston L	586106	6018600	sand on shoulder of tonalite o/c, east side of lake
99DST102	S. Kat L	625357	6064892	beach sand south of greenstone sliver, near granite o/c
99DST103	S. of Sherman L	601872	6038654	silty till near greenstone o/c, heavy to pebbles/stones (20%)
99DST104	S. of Sherman L	602050	6038000	glacial silty till, SW of imv o/c, 40% sand

Sample No	Area	UTM east	UTM north	Description of sampled material
99DST105	S. of Sherman L	603004	6039060	silty till with sand (<.5cm), SW of imv o/c
99DST106	S. of Sherman L	602678	6039191	till with sand SW of int. volc outcrop
99DST107	NW of Sherman L	599079	6042425	silty till with grit (max. size <1cm (20%)), W of drumlins
99DST108	NW of Sherman L	599392	6041663	silty till with grit (max. size <.5cm (30%)), from drumlins
99DST109	NW of Sherman L	600104	6041757	silty till with <.5cm grit, east of drumlin
99DST110	NW of Sherman L	600736	6041417	silty till with 45% sand/pebbles/stones, W. side of NE trending drumlin
99DST111	N. of Sherman L	601493	6041963	silty till, S. of drumlin, with grit
99DST112	N. of Sherman L	601512	6041288	silty till with 30% sand/pebbles, underneath cobble layer
99DST113	N. of Sherman L	602066	6041363	silty till with grit
99DST114	N. of Sherman L	602225	6041353	silty till with grit (<5mm), beneath cobble layer
99DST115	N. of Sherman L	602441	6041775	silty till from beneath cobble layer
99DST116	N. of Sherman L	602901	6041897	silty till with very coarse sand & pebbles (<5cm), from beneath boulders
99DST117	N. of Sherman L	603089	6042244	silty till with very coarse grit (<2cm), beneath cobbles
99DST118	N. of Sherman L	602488	6041569	silty till with clasts <5cm from underneath small cobbles
99DST119	N. of Sherman L	602939	6041607	silty till with high % of mmv cobbles, grit <2cm, S & SW of o/c
99DST120	N. of Sherman L	602066	6040875	med grained sand, 1-2mm dia. - unknown origin
99DST121	Foster L	602627	6041293	silty till beneath stony/cobbly layer, S. of mv o/c
99DST122	Foster L	602655	6041320	sandy, brown, well-sorted till, off mv o/c, 5m fr. Previous
99DST123	Foster L	603027	6041682	silty till with grit <1cm, beneath stony 'desert pavement'
99DST124	SW Gilleran L	534940	6021196	very coarse gravel & sand (some silt) off greenstone o/c very near zinc showing
99DST200	S. Tamblyn L	596896	6020400	coarse grained sand close to esker
99DST201	S. Indian Camp L	610400	6035100	beach sand close to esker, lays between lake and Sachigo R.
99DST202	E. Stables L	605300	6021300	beach sand, lays between granitic bedrock (N) and volcanic rock (S)
99DST203	S. Stables L	603290	6019980	beach sand close to esker (long stretched beach at southern shore, very thick)
99DST204	Chain of Lakes	591240	6013390	fine shore sediments beneath rapids, between boulders (very thin layer of approx. 1-2 cm)
99DST205	Raft L (SE of Dadson L)	612300	6046130	beach sand from isolated island approx. centre of lake
99DST206	Sachigo R.	616600	6037700	beach along river shore
00DST01	Swan Lk	620200	6015100	grey silty aggregate in esker ridge on island.
00DST02	Swan Lk	616900	6016000	coarse sand on bedrock
00DST03	Swan Lk	627100	6012800	beach sand
00DST04	Campsite at Blackbear Lk	599000	6004300	coarse beach sand
00DST05	S Swan Lk	616400	6007200	river sand at beaver dam
00DST06	NE Swan LK	621400	6017050	beach sand below wave base
00DST07	S Swan Lk	628934	6011252	beach Sand
00DST08	S Swan Lk	622081	6000317	beach sand from rocky beach deposit
00DST09	S Swan Lk	622295	5999031	beach sand from rocky beach deposit
00DST10	S Blackbear	598671	5998815	beach sand among boulders 30cm below water
00DST11	S Blackbear	606500	5990000	beach sand among boulders on river bank
00DST12	S Blackbear	598400	5990800	red weathered silty till on granite bedrock ~1m depth
00DST13	NE Swan LK	628600	6028800	fine red sand loess on silty till on bedrock
00DST14	N Yelling Lk	578500	6106800	coarse river sand on bedrock
00DST15	S Carb LK	564600	6066900	grey silty till with a few pebbles ~1m depth beneath organic layer
00DST16	Stull River	534500	6084950	coarse sand to gravel in river bed
00DST17	Stull River	530000	6100000	coarse river sand washed up on bedrock

Sample No	Area	UTM east	UTM north	Description of sampled material
00DST18	N Wuskutumoo Lk	546514	6100303	grit with organic soil on bedrock at stream shore, probably washed from till on higher river bank
00DST100	E Swan Lk	623112	6013972	coarse gravel in fine dark sand (~60%) off imv/ss o/c
00DST101	SW Swan LK	611937	6006599	coarse gravel to fine sand in beach deposit very near to felsic pluton
00DST102	N Swan LK	912252	6015552	fine sand in beach deposit near imv o/c
00DST103	SW Blackbear Lk	582005	5987030	coarse sand (sorted) off tonalite o/c
00DST104	SE Blackbear Lk	601755	5996375	grey silty glacial till reworked/ beach modified bouldery shoreline
00DST105	N Rawley Lk	621782	6007534	fine sand with coarse sand and pebbles direclty off plutonic granite
00DST106	Sachigo River	617892	6037356	very fine sand with silt in a glacial till near mafic metavolcanic o/c
00DST107	NW Swan Lk	608789	6018908	unsorted, mostly silt-sized till of glacial drumlin
00DST108a-e	Richardson Arm	517939	6023521	beach sand , well sorted near bictite tonalite gneiss o/c
00DST109	W Richardson arm	516661	6023795	grey glacial till (from far east side of drumlin?), mostly silty with <5mm grit
00DST110	Monument Bay	519496	6027139	coarse angular-sub angular gravel and sand off mmv o/c (some clay)
00DST111	Monument Bay	518563	6027251	sorted sand and gravel from deposit near msed o/c
00DST112	Monument Bay	517090	6027428	sand and some gravel direclty off msed o/c and rounded boulder lag
00DST200	SE Blackbear Lk	621611	5989184	till from among boulders near river
00DST201	N Blackbear River	630150	5998750	sand from glacial drumlin
00DST202	Namaypoke Lk	606548	6004555	till on lakeside
00DST203	NW Swan Lk	620221	6024127	sand with pebbels near riverside
00DST204	N Blackbear Lk	599167	6012422	coarse sand on bedrock
00DST205a-e	McLeod Lk	564500	6058500	beach sand
00DST206	E McLeod Lk	565000	6057400	sand on SE side of lake
00DST207	N McLeod Lk	566200	6060300	till sample on river bank
00DST208	Central McLeod Lk	564900	6058500	till sample from island
00DST210	W Richardson Arm	520036	6025080	till on down-ice side of outcrop. Clean silty grit
00DST211	NW Richardson Arm	519268	6025124	till beneath muskeg on bedrock. Clean silty grit
00DST212	NW Richardson Arm	517226	6023217	till from rise above river. Clean grey silty grit.
00DST213	NW Richardson Arm	517647	6024073	trill grey, clean silty grit
00DST214	NW Richardson Arm	518800	6025000	till, grey.
00DST215	NW Richardson Arm	517945	6025045	silty till in muskeg
00DST216	NW Richardson Arm	517333	6025000	till from side of hill from an animal hole
00DST400	Se Blackbear	628212	5989045	coarse sand and gravel on boulder beach shoreline

No. of samples: beach=100; till=88; modern alluvium=8; glacio-fluvial=7; glacio-lacustrine=3

Table 2: Sample processing data

Sample	WEIGHT (kgs) WET				WEIGHT (gm)			
Number	Bulk	Table	10.00	Table	Concentrate	M.I.	Non-	Mag.
	Received	Split	Mesh	Feed	Total	Lights	Mag.	
95DST022	15.45	15.45	2.90	12.55	600.10	563.50	30.30	6.30
95DST023	10.85	10.85	3.50	7.35	445.80	440.80	4.10	0.90
95DST024	11.65	11.65	4.10	7.55	468.60	408.00	57.30	3.30
95DST024b	12.80	12.25	3.70	8.55	947.00	292.50	12.70	0.20
95DST025	11.10	11.10	1.40	9.70	286.20	263.00	22.30	0.90
95DST25b	9.45	9.00	0.75	8.25	761.20	321.50	25.60	0.10
95DST026	3.25	3.25	0.00	3.25	359.40	276.20	80.60	80.50
95DST027	8.80	8.80	2.75	6.05	698.50	648.80	37.00	12.70
95DST028	13.65	13.65	5.55	8.10	744.80	714.40	29.00	1.40
95DST029	13.20	13.20	2.20	9.90	639.30	583.70	45.00	10.60
95DST030	8.95	8.95	0.20	8.75	557.60	454.50	91.90	11.20
95DST30b	16.10	15.55	0.05	15.50	1053.50	523.80	15.70	0.20
95DST120	12.95	12.95	4.25	8.70	909.40	820.90	87.10	1.40
95DST120b	12.25	11.65	2.70	8.95	768.90	268.40	11.40	0.30
95DST121	18.65	18.65	5.05	13.60	280.50	250.20	25.40	4.90
95DST121b	11.75	11.15	0.90	10.25	943.10	203.90	19.70	0.90
95DST122	9.75	9.75	2.45	7.30	575.00	523.20	39.60	12.20
95DST123	12.75	12.75	0.00	12.75	600.10	568.00	29.30	2.80
95DST204	11.60	11.60	1.50	10.10	823.90	813.00	10.70	0.20
95DST205	10.90	10.90	0.00	10.90	792.60	787.40	5.10	0.10
95DST206	9.30	9.30	0.90	8.40	636.80	634.10	2.60	0.10
95DST207	14.30	13.75	0.80	12.95	965.10	298.40	46.50	0.50
95DST208b	12.60	12.05	0.30	11.75	1092.80	579.50	156.10	3.30
95DST209	9.60	9.60	0.00	9.60	510.20	497.40	12.50	0.30
95DST209b	10.15	9.60	1.70	7.90	865.90	386.40	50.30	0.60
95DST210	5.70	5.70	0.00	5.70	279.50	266.90	11.80	0.80
96DST01	13.40	n/a	6.25	n/a	332.00	298.00	28.10	5.90
96DST02	8.35	n/a	3.80	n/a	192.80	191.70	19.30	0.80
96DST03	9.65	n/a	4.80	n/a	306.70	300.60	24.90	4.30
96DST04	10.30	n/a	0.00	n/a	615.60	615.30	3.10	0.20
96DST05	7.60	n/a	0.05	n/a	580.50	577.00	52.80	3.40
96DST100	13.75	n/a	7.20	n/a	347.10	341.90	18.60	4.50
96DST101	23.70	n/a	5.20	n/a	641.40	639.30	5.90	0.70
96DST102	12.90	n/a	0.20	n/a	494.70	492.40	58.90	2.20
96DST103	16.70	n/a	0.10	n/a	589.40	587.70	28.40	1.50
96DST201	19.85	n/a	10.50	n/a	569.90	556.50	56.90	10.70
96DST202	18.65	n/a	7.85	n/a	369.10	361.60	33.40	6.60
96DST203	16.50	n/a	1.30	n/a	318.00	315.40	11.30	1.90
97DST01	11.10	10.55	4.05	6.50	888.00	830.80	52.60	4.60
97DST02	7.25	6.75	0.30	6.45	909.50	889.00	19.50	1.00
97DST03	10.85	10.25	0.40	9.85	554.20	551.50	2.60	0.10
97DST04	10.30	9.80	4.05	5.75	1024.90	875.00	129.50	20.40
97DST05	9.00	8.40	0.40	8.00	1369.00	1270.00	98.10	0.90
97DST06	17.50	16.50	4.30	12.20	941.80	899.50	27.80	14.50
97DST07	17.20	16.55	5.60	10.95	823.60	773.70	39.50	10.40
97DST08	12.55	12.05	1.80	10.25	781.30	741.60	34.40	5.30
97DST09	15.45	14.85	2.95	11.90	770.00	737.20	26.70	6.10
97DST100	11.30	10.70	0.25	10.45	1067.80	1042.10	25.70	0.10
97DST101	10.40	9.90	0.10	9.80	942.50	908.00	33.30	1.20
97DST102	14.75	14.10	0.30	13.80	1181.40	1143.20	37.80	0.40
97DST103	12.15	11.55	0.05	11.50	1028.70	737.70	284.60	6.40
97DST104	11.55	10.80	0.15	10.65	966.10	954.90	10.60	0.60
97DST105	12.00	12.30	0.70	11.60	755.30	620.50	126.30	8.50

Sample	WEIGHT (kgs) WET				WEIGHT (gm)			
Number	Bulk	Table	10.00	Table	Concentrate	M.I.	Non-	Mag.
	Received	Split	Mesh	Feed	Total	Lights	Mag.	
97DST106	16.75	16.30	0.15	16.15	1306.00	1297.20	8.60	0.20
97DST107	14.50	13.80	0.45	13.35	1070.50	1051.20	18.80	0.50
97DST108	9.40	8.80	0.25	8.55	778.60	726.40	41.50	10.70
97DST109	18.10	17.40	11.20	6.20	626.10	595.20	21.20	9.70
97DST110	12.65	12.10	1.00	11.10	991.80	945.20	44.80	1.80
98DST01	10.40	9.60	4.00	5.60	894.50	797.80	94.30	2.40
98DST02	7.20	6.90	4.20	2.80	355.10	332.40	21.30	1.40
98DST03	7.90	7.40	4.20	3.20	478.50	466.00	12.30	0.20
98DST04	11.60	11.10	3.60	7.50	789.40	747.90	31.80	9.70
98DST05	11.20	10.60	1.30	9.40	1069.30	1018.40	38.10	12.80
98DST07	8.30	7.80	1.60	6.20	524.30	500.40	20.90	3.00
98DST100	9.00	8.40	3.60	4.90	826.40	789.90	56.20	0.30
98DST101	5.00	4.50	0.60	3.90	572.20	560.60	11.40	0.20
98DST102	10.60	10.10	5.90	4.20	441.20	416.50	22.70	2.00
98DST105	16.00	15.50	0.40	15.20	816.80	759.80	56.50	0.50
98DST300	10.80	10.40	0.50	9.90	823.40	765.40	56.70	1.30
98DST301	16.80	16.30	0.00	16.30	971.50	904.50	66.20	0.80
98DST302	13.50	13.00	5.70	7.30	690.10	639.30	45.10	5.70
98DST303	10.80	10.30	0.50	9.80	800.20	766.60	33.20	0.40
98DST304	11.50	11.00	0.00	11.00	549.90	533.60	16.20	0.10
99DST02	14.2	13.4	3.6	9.8	914.9	346.6	52.5	5
99DST03		9.5	0.7	8.8	641.9	626.5	12.5	2.9
99DST04		9.9	1.4	8.5	661.4	621.4	35.9	4.1
99DST05		9.6	1.4	8.2	659.5	626.7	25.2	7.6
99DST06		12.3	0.8	11.5	360.7	332.5	24.7	3.5
99DST07		9.4	1.5	7.9	303.1	289.9	9.6	3.6
99DST08		10.2	1.5	8.7	333.1	292.0	31.5	9.6
99DST09		9.8	1.6	8.2	376.7	350.3	20.3	6.1
99DST10		9.7	1.4	8.3	244.9	214.1	23.2	7.6
99DST11		9.0	0.7	8.3	397.1	336.9	51.2	9.0
99DST12		9.6	1.0	8.6	228.8	204.4	18.2	6.2
99DST13		9.6	0.9	8.7	376.7	348.6	22.5	5.6
99DST14		8.8	1.8	7.0	341.8	310.9	28.4	2.5
99DST15		9.6	1.8	7.8	291.1	266.0	20.4	4.7
99DST16		9.6	1.0	8.6	432.6	401.8	24.1	6.7
99DST17		9.1	1.1	8.0	373.6	346.3	21.1	6.2
99DST18		9.1	2.3	6.8	276.1	250.2	19.5	6.4
99DST19		9.0	0.9	8.1	317.4	301.4	13.5	2.5
99DST20		8.1	0.4	7.7	300.1	290.0	10.0	0.1
99DST21		9.0	0.8	8.2	232.4	213.9	15.7	2.8
99DST22		9.5	1.7	7.8	318.1	292.4	25.4	0.3
99DST23		8.0	0.4	7.6	373.7	360.6	12.8	0.3
99DST24		8.1	0.6	7.5	347.8	337.9	9.1	0.8
99DST25		8.4	1.0	7.4	264.2	247.4	14.9	1.9
99DST26		8.5	1.7	6.8	345.2	310.0	34.2	1.0
99DST27		9.2	2.3	6.9	243.3	207.6	31.4	4.3
99DST28		8.9	0.9	8.0	263.1	252.5	8.5	2.1
99DST29		7.8	0.7	7.1	324.7	302.5	20.6	1.6
99DST30		9.2	0.9	8.3	294.1	271.2	19.2	3.7
99DST31		9.2	2.8	6.4	320.2	305.1	10.5	4.6
99DST32	8.3	7.8	2.1	5.7	915.2	883.8	27.5	3.9
99DST33	8.5	8.1	0.7	7.4	826.9	813.6	9.1	4.2
99DST34	7.7	7.3	3.4	3.9	687.9	679.3	6.7	1.9
99DST35	7.4	7	1.3	5.7	596.6	589.7	5.1	1.8
99DST36	8.7	8.2	2.6	5.6	806.6	772.9	24.6	9.1

Sample	WEIGHT (kgs) WET					WEIGHT (gm)			
Number	Bulk	Table	10.00	Table		Concentrate	M.I.	Non-	Mag.
	Received	Split	Mesh	Feed		Total	Lights	Mag.	
99DST37	7	6.5	0.9	5.6		794.1	770.7	18.8	4.6
99DST38	9.2	8.8	3.1	5.7		1201.6	1161.7	32	7.9
99DST39	8	7.5	0.6	6.9		815.7	760.4	40.6	14.7
99DST40	7.5	7.1	1.9	5.2		753.8	693.5	57.9	2.4
99DST41	9.9	9.5	3.3	6.2		892.1	859.6	27.1	5.4
99DST42	10.5	10	0.5	9.5		690.8	677.8	9.7	3.3
99DST43	10.3	9.8	1.5	8.3		533.6	528.8	3.8	1
99DST44	10.5	10	3.1	6.9		918.1	891.8	21.7	4.6
99DST45	8.8	8.4	0.8	7.6		714.4	684.5	27.8	2.1
99DST46	10.5	10.2	1.5	8.7		732.4	703.8	23.8	4.8
99DST47	10	9.5	2.2	7.3		492.1	475.7	13.8	2.6
99DST48	10.7	10.3	0.5	9.8		750.3	712.1	35.5	2.7
99DST49	10.4	9.8	1.5	8.3		955.6	927.8	24.6	3.2
99DST50	10	9.6	1.2	8.4		654.6	609.1	39.7	5.8
99DST100	5.5	5.2	0.4	4.8		1046.5	712.7	333	0.8
99DST101	11.4	11	1.6	9.4		864.3	851.5	12.6	0.2
99DST102	11.5	11	0	11		1105.2	1099	6.1	0.1
99DST103		9.3	2.9	6.4		337.6	305.0	24.5	8.1
99DST104		9.7	0.9	8.8		373.4	317.5	41.9	14.0
99DST105		10.4	0.8	9.6		364.3	332.8	25.2	6.3
99DST106		8.6	0.6	8.0		390.5	358.9	27.3	4.3
99DST107		8.7	1.0	7.7		322.2	299.0	18.6	4.6
99DST108		9.1	0.7	8.4		299.2	277.3	17.3	4.6
99DST109		8.2	0.7	7.5		238.1	223.8	11.6	2.7
99DST110		10.1	1.3	8.8		314.5	278.8	26.9	8.8
99DST111		8.8	1.4	7.4		348.3	316.9	24.8	6.6
99DST112		7.9	0.8	7.1		307.2	284.9	20.0	2.3
99DST113		9.7	0.6	9.1		314.0	281.3	28.9	3.8
99DST114		9.2	1.1	8.1		296.1	266.5	23.1	6.5
99DST115		9.1	0.9	8.2		286.7	266.4	15.3	5.0
99DST116		9.1	1.1	8.0		261.0	233.4	21.1	6.5
99DST117		9.8	1.2	8.6		338.6	303.9	27.3	7.4
99DST118		7.4	1.4	6.0		355.1	332.7	21.0	1.4
99DST119		7.6	0.5	7.1		273.0	252.0	19.4	1.6
99DST120		8.1	1.8	6.3		341.2	337.6	3.1	0.5
99DST121		8.6	1.3	7.3		301.4	273.8	22.8	4.8
99DST122		9.5	1.7	7.8		313.4	295.5	17.6	0.3
99DST123		7.8	0.5	7.3		372.7	336.3	29.4	7.0
99DST124	11.9	11.4	5	6.4		721.3	665.3	54.9	1.1
99DST200	9.9	9.3	1.5	7.8		776	775.7	0.2	0.1
99DST201	11.7	11.2	0.9	10.3		845	822.9	21.7	0.4
99DST202	12.2	11.8	0.1	11.7		1080.8	1028.2	52.5	0.1
99DST203	13.1	12.5	0.1	12.4		995.8	966.6	28.6	0.6
99DST204	7.8	7.3	1	6.3		962.3	937.5	24.5	0.3
99DST205	11.9	11.5	7.1	4.4		532.8	519.9	7.8	5.1
99DST206	13.7	13.2	5.7	7.5		845.2	815	25.5	4.7
00DST01	11.7	11.3	1.4	9.9		499	471	20.8	7.2
00DST02	9.4	9.1	1.7	7.4		683.8	662.2	20.4	1.2
00DST03	9.4	9.1	0.8	8.3		755.4	665	82.9	7.5
00DST04	15	14.6	8	6.6		735.2	721.8	10.7	2.7
00DST05	10.7	10.3	5.9	4.4		434.4	399.4	25.4	9.6
00DST06	10.2	9.7	4.7	5		427.7	390.2	34.5	3
00DST07	12.4	12	5.8	6.2		508.8	447.1	57	4.7
00DST08	10.9	10.5	4.5	6		350.9	297.1	43.9	9.9
00DST09	8.9	8.6	3.1	5.5		327	276.8	47.3	2.9

Sample	WEIGHT (kgs) WET					WEIGHT (gm)			
Number	Bulk	Table	10.00	Table		Concentrate	M.I.	Non-	Mag.
	Received	Split	Mesh	Feed		Total	Lights	Mag.	
00DST10	10.7	10.2	3.8	6.4		347.4	288.4	57.3	1.7
00DST11	8.6	8.3	2.5	5.8		295.9	290.3	4.4	1.2
00DST12	9.5	9.1	1.7	7.4		553.8	514.7	30.4	8.7
00DST13	7.5	7.2	0.2	7		543.6	506.5	33.3	3.8
00DST14	11	10.6	3.7	6.9		461	433.1	25.1	2.8
00DST15	7.3	7	0.6	6.4		422.9	415.4	6.3	1.2
00DST16	12.7	12.2	7	5.2		205.8	174.8	29.9	1.1
00DST17	9.8	9.4	0.1	9.3		923.6	911.1	11.9	0.6
00DST18	7.4	7.2	2.5	4.7		222.5	192.4	25.9	4.2
00DST100	9.4	9	2.5	6.5		992.4	927.4	62.3	2.7
00DST101	9.9	9.5	1.8	7.7		464.2	396.3	67.3	0.6
00DST102	7.7	7.3	0.5	6.8		447.7	339	104.1	4.6
00DST103	7.7	7.4	1.3	6.1		647.8	519.4	123.5	4.9
00DST104	12.7	12.3	2.9	9.4		943.4	922	19.7	1.7
00DST105	8.2	8	1.7	6.3		334.9	289.6	29.1	16.2
00DST106	9.8	9.3	0.5	8.8		985.2	976.3	6.8	2.1
00DST107	9.2	8.9	1.4	7.5		323.5	297.5	20.3	5.7
00DST108a-e	79.9	79.5	0.9	78.6		2970.9	1817.4	267.2	193.1
00DST109	9.4	9.1	0.9	8.2		635.9	626.5	7.4	2
00DST110	13.2	12.7	2.6	10.1		910.4	855.1	46.4	8.9
00DST111	12	11.6	2.4	9.2		484	408.8	74	1.2
00DST112	10.1	9.8	3	6.8		375.9	345.4	29.4	1.1
00DST200	12.2	11.8	1.3	10.5		421.3	392.2	23.9	5.2
00DST201	10.5	10	0.8	9.2		329.3	262.3	54.9	12.1
00DST202	13.4	13	2.8	10.2		459.4	396.4	60.1	2.9
00DST203	12.4	12	2.7	9.3		345.4	314.8	26.8	3.8
00DST204	8.3	7.9	1.2	6.7		494.4	487.7	6.6	0.06
00DST205a	19	18.6	0.2	18.4		974	720.1	228.6	25.3
00DST206	15.4	15	2.9	12.1		989.4	860.1	116.5	12.8
00DST207	12.3	11.9	4.2	7.7		411.2	370.3	40	0.9
00DST208	14.6	14.1	4.9	9.2		374.6	322.7	40.3	11.6
00DST210	11.4	11	0.7	10.3		195.4	156.9	30.8	7.7
00DST211	11.3	11	1.1	9.9		558.5	518.5	32.4	7.6
00DST212	13.2	12.9	1.8	11.1		327.6	283.3	35.4	8.9
00DST213	13.5	13.1	0.9	12.2		803.7	774.6	23.6	5.5
00DST214	11.7	11.2	1.2	10		201.5	170.1	24.8	6.6
00DST215	10.6	10.2	1.1	9.1		215.1	189.7	20.6	4.8
00DST216	12.2	11.7	1.4	10.3		251.6	201	42.5	8.1
00DST400	9.6	9.2	3.3	5.9		402.9	353	46.5	3.4

Table 3: Summary of gold grain shapes

Sample Number	Number of Visible Gold Grains				Non-Mag Wt. (gms)	Calculated PPB Visible Gold			
	Total	Reshaped	Modified	Pristine		Total	Reshaped	Modified	Pristine
95DST022	1	1	0	0	30.3	70	70	0	0
95DST023	0	0	0	0	4.1	0	0	0	0
95DST024	0	0	0	0	57.3	0	0	0	0
95DST024b	0	0	0	0	34.2	0	0	0	0
95DST025	0	0	0	0	22.3	0	0	0	0
95DST025b	0	0	0	0	33.0	0	0	0	0
95DST026	0	0	0	0	80.6	0	0	0	0
95DST027	0	0	0	0	37.0	0	0	0	0
95DST028	0	0	0	0	29.0	0	0	0	0
95DST029	3	1	1	1	45.0	4	2	1	2
95DST030	0	0	0	0	91.9	0	0	0	0
95DST030b	0	0	0	0	62.0	0	0	0	0
95DST120	1	1	0	0	87.1	2	2	0	0
95DST120b	0	0	0	0	35.8	0	0	0	0
95DST121	5	0	2	3	25.4	47	0	17	30
95DST121b	3	3	0	0	41.0	16	16	0	0
95DST122	3	0	2	1	39.6	16	0	14	2
95DST123	0	0	0	0	29.3	0	0	0	0
95DST204	0	0	0	0	10.7	0	0	0	0
95DST205	0	0	0	0	5.1	0	0	0	0
95DST206	0	0	0	0	2.6	0	0	0	0
95DST207b	0	0	0	0	51.8	0	0	0	0
95DST208b	0	0	0	0	47.0	0	0	0	0
95DST209	1	1	0	0	12.5	51	51	0	0
95DST209b	0	0	0	0	31.6	0	0	0	0
95DST210	0	0	0	0	11.8	0	0	0	0
96DST01	2	1	1	0	28.1	43	7	36	0
96DST02	0	0	0	0	19.3	0	0	0	0
96DST03	3	1	2	0	24.9	19	15	4	0
96DST04	0	0	0	0	3.1	0	0	0	0
96DST05	0	0	0	0	52.8	0	0	0	0
96DST100	1	1	0	0	18.6	20	20	0	0
96DST101	1	1	0	0	5.9	109	109	0	0
96DST102	2	0	2	0	58.9	13	0	13	0
96DST103	0	0	0	0	28.4	0	0	0	0
96DST201	0	0	0	0	56.9	0	0	0	0
96DST202	18	6	6	6	33.4	15	10	3	2
96DST203	0	0	0	0	11.3	0	0	0	0
97DST01	0	0	0	0	26.0	0	0	0	0
97DST02	0	0	0	0	25.8	0	0	0	0
97DST03	0	0	0	0	39.4	0	0	0	0
97DST04	0	0	0	0	23.0	0	0	0	0
97DST05	0	0	0	0	32.0	0	0	0	0
97DST06	1	1	0	0	48.8	13	13	0	0
97DST07	1	1	0	0	43.8	34	34	0	0
97DST08	0	0	0	0	41.0	0	0	0	0
97DST09	0	0	0	0	47.6	0	0	0	0

Sample Number	Number of Visible Gold Grains				Non-Mag Wt. (gms)	Calculated PPB Visible Gold			
	Total	Reshaped	Modified	Pristine		Total	Reshaped	Modified	Pristine
97DST100	0	0	0	0	41.8	0	0	0	0
97DST101	0	0	0	0	39.2	0	0	0	0
97DST102	0	0	0	0	55.2	0	0	0	0
97DST103	0	0	0	0	46.0	0	0	0	0
97DST104	0	0	0	0	42.6	0	0	0	0
97DST105	0	0	0	0	46.4	0	0	0	0
97DST106	0	0	0	0	64.6	0	0	0	0
97DST107	0	0	0	0	53.4	0	0	0	0
97DST108	0	0	0	0	34.2	0	0	0	0
97DST109	1	1	0	0	24.8	15	15	0	0
97DST110	0	0	0	0	44.4	0	0	0	0
98 DST01	1	0	1	0	94.3	1	0	1	0
98DST02	0	0	0	0	21.3	0	0	0	0
98DST03	0	0	0	0	12.3	0	0	0	0
98DST04	0	0	0	0	31.8	0	0	0	0
98DST05	6	5	1	0	38.1	4	1	2	0
98DST07	0	0	0	0	20.9	0	0	0	0
98DST100	0	0	0	0	56.2	0	0	0	0
98DST101	0	0	0	0	11.4	0	0	0	0
98DST102	0	0	0	0	22.7	0	0	0	0
98DST105	0	0	0	0	56.5	0	0	0	0
98DST300	0	0	0	0	56.7	0	0	0	0
98DST301	0	0	0	0	66.2	0	0	0	0
98DST302	0	0	0	0	45.1	0	0	0	0
98DST303	0	0	0	0	33.2	0	0	0	0
98DST304	0	0	0	0	16.2	0	0	0	0
99DST02	1	1	0	0	53.6	4	4	0	0
99DST03	7	5	2	0	12.5	257	248	8	0
99DST04	11	3	2	6	35.9	20	4	8	8
99DST05	11	9	1	1	25.2	22	21	0	1
99DST06	12	8	1	3	24.7	76	64	8	4
99DST07	4	2	1	1	9.6	15	11	1	3
99DST08	8	7	1	0	31.5	152	149	3	0
99DST09	18	7	2	9	20.3	81	57	5	19
99DST10	8	6	2	0	23.2	20	12	9	0
99DST11	19	17	1	1	51.2	33	32	2	0
99DST12	3	2	0	1	18.2	15	15	0	0
99DST13	7	4	1	2	22.5	37	35	1	1
99DST14	3	2	1	0	28.4	10	10	0	0
99DST15	3	2	0	1	20.4	8	5	0	3
99DST16	4	3	0	1	24.1	32	30	0	2
99DST17	8	6	1	1	21.1	16	12	1	4
99DST18	9	9	0	0	19.5	16	16	0	0
99DST19	9	9	0	0	13.5	24	24	0	0
99DST20	69	3	9	57	10.0	613	54	46	513
99DST21	1	1	0	0	15.7	5	5	0	0
99DST22	14	8	0	6	25.4	35	16	0	19
99DST23	4	2	0	2	12.8	78	56	0	21
99DST24	2	2	0	0	9.1	18	18	0	0

Sample Number	Number of Visible Gold Grains				Non-Mag	Calculated PPB Visible Gold			
	Total	Reshaped	Modified	Pristine	Wt. (gms)	Total	Reshaped	Modified	Pristine
99DST25	10	5	4	1	14.9	99	24	74	1
99DST26	4	3	1	0	34.2	20	17	2	0
99DST27	12	9	2	1	31.4	21	20	1	1
99DST28	37	6	4	27	8.5	211	28	15	168
99DST29	3	0	0	3	20.6	5	0	0	5
99DST30	10	6	1	3	19.2	78	51	4	23
99DST31	1	0	1	0	10.5	2	0	2	0
99DST32	1	1	0	0	31.2	3	3	0	0
99DST33	3	3	0	0	32.4	8	8	0	0
99DST34	2	1	1	0	29.2	4	3	1	0
99DST35	3	3	0	0	28	11	11	0	0
99DST36	4	4	0	0	32.8	15	15	0	0
99DST37	8	7	1	0	26	17	17	0	0
99DST38	11	9	2	0	35.2	35	30	5	0
99DST39	17	14	2	1	30	174	164	4	6
99DST40	3	3	0	0	28.4	20	20	0	0
99DST41	3	1	0	2	38	2	1	0	1
99DST42	1	1	0	0	40	5	5	0	0
99DST43	0	0	0	0	39.2	0	0	0	0
99DST44	3	3	0	0	40	48	48	0	0
99DST45	1	0	1	0	33.6	6	0	6	0
99DST46	1	1	0	0	40.8	1	1	0	0
99DST47	2	2	0	0	38	15	15	0	0
99DST48	1	1	0	0	41.2	2	2	0	0
99DST49	0	0	0	0	39.2	0	0	0	0
99DST50	2	1	0	1	38.4	10	10	0	0
99DST100	0	0	0	0	20.8	0	0	0	0
99DST101	0	0	0	0	44	0	0	0	0
99DST102	0	0	0	0	44	0	0	0	0
99DST103	2	2	0	0	24.5	11	11	0	0
99DST104	1	1	0	0	41.9	2	2	0	0
99DST105	3	3	0	0	25.2	7	7	0	0
99DST106	9	8	0	1	27.3	33	32	0	1
99DST107	2	2	0	0	18.6	2	2	0	0
99DST108	3	1	2	0	17.3	14	0	14	0
99DST109	2	1	1	0	11.6	39	32	7	0
99DST110	7	3	4	0	26.9	13	9	5	0
99DST111	7	5	1	1	24.8	23	13	2	8
99DST112	9	7	2	0	20.0	59	58	2	0
99DST113	7	7	0	0	28.9	35	35	0	0
99DST114	3	2	1	0	23.1	2	1	1	0
99DST115	6	3	0	3	15.3	30	19	0	11
99DST116	6	6	0	0	21.1	48	48	0	0
99DST117	10	9	0	1	27.3	32	30	0	2
99DST118	2	2	0	0	21.0	2	2	0	0
99DST119	8	3	0	5	19.4	23	5	0	18
99DST120	7	5	0	2	3.1	510	476	0	34
99DST121	0	0	0	0	22.8	0	0	0	0
99DST122	4	1	1	2	17.6	7	5	1	2

Sample Number	Number of Visible Gold Grains				Non-Mag Wt. (gms)	Calculated PPB Visible Gold			
	Total	Reshaped	Modified	Pristine		Total	Reshaped	Modified	Pristine
99DST123	4	4	0	0	29.4	12	12	0	0
99DST124	2	2	0	0	45.6	779	779	0	0
99DST200	0	0	0	0	37.2	0	0	0	0
99DST201	0	0	0	0	44.8	0	0	0	0
99DST202	0	0	0	0	47.2	0	0	0	0
99DST203	0	0	0	0	50	0	0	0	0
99DST204	0	0	0	0	29.2	0	0	0	0
99DST205	0	0	0	0	46	0	0	0	0
99DST206	0	0	0	0	52.8	0	0	0	0
00DST01	0	0	0	0	39.6	0	0	0	0
00DST02	0	0	0	0	29.6	0	0	0	0
00DST03	2	2	0	0	33.2	12	12	0	0
00DST04	0	0	0	0	26.4	0	0	0	0
00DST05	0	0	0	0	17.6	0	0	0	0
00DST06	0	0	0	0	20	0	0	0	0
00DST07	0	0	0	0	24.8	0	0	0	0
00DST08	0	0	0	0	24	0	0	0	0
00DST09	0	0	0	0	22	0	0	0	0
00DST10	0	0	0	0	25.6	0	0	0	0
00DST11	0	0	0	0	23.2	0	0	0	0
00DST12	0	0	0	0	29.6	0	0	0	0
00DST13	0	0	0	0	28	0	0	0	0
00DST14	0	0	0	0	27.6	0	0	0	0
00DST15	0	0	0	0	25.6	0	0	0	0
00DST16	0	0	0	0	20.8	0	0	0	0
00DST17	0	0	0	0	37.2	0	0	0	0
00DST18	0	0	0	0	18.8	0	0	0	0
00DST100	0	0	0	0	26	0	0	0	0
00DST101	0	0	0	0	30.8	0	0	0	0
00DST102	0	0	0	0	27.2	0	0	0	0
00DST103	0	0	0	0	24.4	0	0	0	0
00DST104	1	1	0	0	37.6	2	2	0	0
00DST105	0	0	0	0	25.2	0	0	0	0
00DST106	1	1	0	0	35.2	1	1	0	0
00DST107	0	0	0	0	30	0	0	0	0
00DST108a	1	1	0	0	67.2	6	6	0	0
00DST109	0	0	0	0	32.8	0	0	0	0
00DST110	0	0	0	0	40.4	0	0	0	0
00DST111	0	0	0	0	36.8	0	0	0	0
00DST112	4	3	1	0	27.2	126	123	3	0
00DST200	0	0	0	0	42	0	0	0	0
00DST201	3	3	0	0	36.8	8	8	0	0
00DST202	0	0	0	0	40.8	0	0	0	0
00DST203	0	0	0	0	37.2	0	0	0	0
00DST204	0	0	0	0	26.8	0	0	0	0
00DST205a	0	0	0	0	73.6	0	0	0	0
00DST206	1	1	0	0	48.4	4	4	0	0
00DST207	0	0	0	0	30.8	0	0	0	0
00DST208	1	1	0	0	36.8	10	10	0	0

+2-7

Sample	Number of Visible Gold Grains				Non-Mag	Calculated PPB Visible Gold			
Number	Total	Reshaped	Modified	Pristine	Wt. (gms)	Total	Reshaped	Modified	Pristine
00DST210	1	1	0	0	41.2	2	2	0	0
00DST211	0	0	0	0	39.6	0	0	0	0
00DST212	0	0	0	0	44.4	0	0	0	0
00DST213	0	0	0	0	48.8	0	0	0	0
00DST214	0	0	0	0	40	0	0	0	0
00DST215	5	5	0	0	36.4	17	17	0	0
00DST216	1	1	0	0	41.2	36	36	0	0
00DST400	0	0	0	0	23.6	0	0	0	0

Samples from the detailed survey in the area of the Sachigo River Mine are bolded (see Stone, Halle and Lange, 2000).

Table 4: Gold grain size and shape data.

Sample Number	Panned Y/N	Measurement (Microns)	Diameter Thickness (Microns)	NUMBER OF GRAINS							REMARKS
				RESHAPED		MODIFIED		PRISTINE		TOTAL	
				T	P	T	P	T	P		
95DST022	N	50 x 175	22 C	1						1	
			TOTAL:	1						1	
95DST023	N	NO VISIBLE GOLD									
95DST024	N	NO VISIBLE GOLD									
95DST024b	N	NO VISIBLE GOLD									
95DST025	N	NO VISIBLE GOLD									
95DST025b	N	NO VISIBLE GOLD									
95DST026	N	NO VISIBLE GOLD									
95DST027	N	NO VISIBLE GOLD									
95DST028	N	NO VISIBLE GOLD									
95DST029	Y	25 x 25	5 C			1				1	No Sulphides
		25 x 50	8 C	1				1		2	
			TOTAL:	1		1		1		3	
95DST030	N	NO VISIBLE GOLD									
95DST30b	N	NO VISIBLE GOLD									
95DST120	N	NO VISIBLE GOLD									
95DST120b	N	NO VISIBLE GOLD									

Sample Number	Panned Y/N	Measurement (Microns)	Diameter Thickness (Microns)	NUMBER OF GRAINS							REMARKS
				RESHAPED		MODIFIED		PRISTINE		TOTAL	
				T	P	T	P	T	P		
95DST121	Y	15 x25	4 C					1		1	No Sulphides
		15 x 50	7 C			1				1	
		25 x 100	13 C					1		1	
		50 x 75	13 C			1			1	2	
			Total:			2		2	1	5	
95DST121b	Y	25 x 50	8 C	1						1	
		50 x 50	10 C	1						1	
		50 x 75	13 C	1						1	
			TOTAL:	3						3	
95DST122	Y	25 x 50	8 C					1		1	
		25 x 100	13 C			1				1	
		50 x 50	10 C				1			1	
			TOTAL:			1	1	1		3	
95DST123	N	NO VISIBLE GOLD									
95DST204	N	NO VISIBLE GOLD									
95DST205	N	NO VISIBLE GOLD									
95DST206	N	NO VISIBLE GOLD									
95DST207b	N	NO VISIBLE GOLD									
95DST208b	N	NO VISIBLE GOLD									
95DST209	N	75 X 75	15 C	1						1	
			TOTAL:	1						1	
95DST209b	N	NO VISIBLE GOLD									
95DST210	N	NO VISIBLE GOLD									

Sample Number	Panned Y/N	Measurement (Microns)	Diameter Thickness (Microns)	NUMBER OF GRAINS							REMARKS
				RESHAPED		MODIFIED		PRISTINE		TOTAL	
				T	P	T	P	T	P		
96DST01	N	50 X 50	10 C	1						1	
		50 X 125	18 C			1				1	
			TOTAL:	1		1				2	
96DST02	N	NO VISIBLE GOLD									
96DST03	N	25 X 25	5 C			1				1	
		25 X 50	8 C			1				1	
		50 X 75	13 C	1						1	
			TOTAL:	1		2				3	
96DST04	N	NO VISIBLE GOLD									
96DST05	N	NO VISIBLE GOLD									
96DST100	N	50 X 75	13 C	1						1	
			TOTAL:	1						1	
96DST101	N	50 X 100	15 C	1						1	
			Total	1						1	
96DST102	N	50 X 75	13 C			2				2	
			TOTAL:			2				2	
96DST103	N	NO VISIBLE GOLD									
96DST201	N	NO VISIBLE GOLD									

Sample Number	Panned Y/N	Measurement (Microns)	Diameter Thickness (Microns)	NUMBER OF GRAINS							REMARKS
				RESHAPED		MODIFIED		PRISTINE		TOTAL	
				T	P	T	P	T	P		
96DST202	Y	15 X 15	3 C				2	1	2	5	No sulphides.
		15 X 25	4 C	1	1	1	1	1	1	6	
		25 X 25	5 C	1	1	2		1		5	
		25 X 50	8 C	1						1	
		50 X 50	10 C		1					1	
			TOTAL:	3	3	3	3	3	3	18	
96DST203	N	NO VISIBLE GOLD									
97DST01	N	NO VISIBLE GOLD									
97DST02	N	NO VISIBLE GOLD									1 ball of mercury (50µ).
97DST03	N	NO VISIBLE GOLD									
97DST04	N	NO VISIBLE GOLD									
97DST05	N	NO VISIBLE GOLD									
97DST06	N	50 X 100	15 C	1						1	
			TOTAL:	1						1	
97DST07	N	75 X 125	20 C	1						1	
			TOTAL:	1						1	
97DST08	N	NO VISIBLE GOLD									
97DST09	N	NO VISIBLE GOLD									
97DST100	N	NO VISIBLE GOLD									
97DST101	N	NO VISIBLE GOLD									

Sample Number	Panned Y/N	Measurement (Microns)	Diameter Thickness (Microns)	NUMBER OF GRAINS							REMARKS
				RESHAPED		MODIFIED		PRISTINE		TOTAL	
				T	P	T	P	T	P		
97DST102	N	NO VISIBLE GOLD									
97DST103	N	NO VISIBLE GOLD									
97DST104	N	NO VISIBLE GOLD									
97DST105	N	NO VISIBLE GOLD									
97DST106	N	NO VISIBLE GOLD									
97DST107	N	NO VISIBLE GOLD									
97DST108	N	NO VISIBLE GOLD									
97DST109	N	50 X 75	13 C	1						1	
			Total:	1						1	
97DST110	N	NO VISIBLE GOLD									
98DST01	N	15 X 50	7 C			1				1	
			Total:			1				1	
98DST02	N	NO VISIBLE GOLD									
98DST03	N	NO VISIBLE GOLD									
98DST04	N	NO VISIBLE GOLD									
98DST05	Y	10 X 10	2 C	3						3	No sulphides
		25 X 25	5 C	2						2	
		25 X 50	8 C				1			1	
			Total:	5			1			6	

Sample Number	Panned Y/N	Measurement (Microns)	Diameter Thickness (Microns)	NUMBER OF GRAINS							REMARKS
				RESHAPED		MODIFIED		PRISTINE		TOTAL	
				T	P	T	P	T	P		
98DST07	N	NO VISIBLE GOLD									
98DST100	N	NO VISIBLE GOLD									
98DST101	N	NO VISIBLE GOLD									
98DTS102	N	NO VISIBLE GOLD									
98DST105	N	NO VISIBLE GOLD									
98DST300	N	NO VISIBLE GOLD									
98DST301	N	NO VISIBLE GOLD									
98DST302	N	NO VISIBLE GOLD									
98DST303	N	NO VISIBLE GOLD									
98DST304	N	NO VISIBLE GOLD									
99DST02	N	25X75	10C	1						1	
			total:	1						1	
99DST03	Y	15X50	7C	2						2	no sulphides
		25X25	5C	1		1				2	
		25X50	8C		1	1				2	
		75X175	25C	1						1	
			total:	4	1	2				7	
99DST32	N	25X50	7.7C	1						1	
			total:	1						1	

Sample Number	Panned Y/N	Measurement (Microns)	Diameter Thickness (Microns)	NUMBER OF GRAINS							REMARKS
				RESHAPED		MODIFIED		PRISTINE		TOTAL	
				T	P	T	P	T	P		
99DST33	N	15X50	6.7C	1						1	
		25X25	5.2C	1						1	
		25X75	10.3C	1						1	
			total:	3						3	
99DST34	N	25X25	5.2C			1				1	
		25X50	7.7C	1						1	
			total:	1		1				2	
99DST35	N	25X25	5.2C	1						1	
		25X50	7.7C	1						1	
		50X50	10.3C	1						1	
			total:	3						3	
99DST36	N	15X25	4.2C	1						1	
		25X25	5.2C	1						1	
		25X50	7.7C	1						1	
		50X75	12.7C	1						1	
			total:	4						4	
99DST37	Y	15X25	4.2C	1		1				2	1 grain cinnabar.
		25X25	5.2C	2	1					3	
		25X50	7.7C	2						2	
		25X75	10.3C		1					1	
			total:	5	2	1				8	
99DST38	Y	25X25	5.2C	2						2	No sulphides.
		25X50	7.7C	3		2				5	
		25X75	10.3C	2	1					3	
		50X50	10.3C	1						1	
			total:	8	1	2				11	

Sample Number	Panned Y/N	Measurement (Microns)	Diameter Thickness (Microns)	NUMBER OF GRAINS							REMARKS
				RESHAPED		MODIFIED		PRISTINE		TOTAL	
				T	P	T	P	T	P		
99DST39	Y	15X15	3.1C	1						1	No sulphides.
		15X50	6.7C	1		2				3	
		25X25	5.2C	4						4	
		25X50	7.7C		1					1	
		25X75	10.3C		1					1	
		50X50	10.3C	1	2			1		4	
		50X75	12.7C	1						1	
		50X1200	15.2C		1					1	
		100X150	24.7C	1						1	
			total:	9	5	2		1		17	
99DST40	N	50X50	10.3C	3						3	
			total:	3						3	
99DST41	N	15X15	3.2C					1		1	
		15X50	6.7C	1						1	
		25X25	5.2C					1		1	
			total:	1				2		3	
99DST42	N	50X50	10.3C	1						1	
			total:	1						1	
99DST43	N	NO VISIBLE GOLD									
99DST44	N	15X50	6.7C	1						1	
		50X75	12.7C	1						1	
		100X100	20C	1						1	
			total:	3						3	
99DST45	N	50X50	10.3C			1				1	
			total:			1				1	
99DST46	N	15X50	6.7C	1						1	
			total:	1						1	

Sample Number	Panned Y/N	Measurement (Microns)	Diameter Thickness (Microns)	NUMBER OF GRAINS							REMARKS
				RESHAPED		MODIFIED		PRISTINE		TOTAL	
				T	P	T	P	T	P		
99DST47	N	50X50	10.3C	1						1	
		50X75	12.7C	1						1	
			total:	2						2	
99DST48	N	25X50	7.7C	1						1	
			total:	1						1	
99DST49	N	NO VISIBLE GOLD									
99DST50	N	15X15	3.1C					1		1	
		50X75	12.7C	1						1	
			total:	1				1		2	
99DST100	N	NO VISIBLE GOLD									
99DST101	N	NO VISIBLE GOLD									
99DST102	N	NO VISIBLE GOLD									
99DST124	N	50X75	12.7C	1						1	
		200X300	75M	1						1	
			total:	2						2	
99DST200	N	NO VISIBLE GOLD									
99DST201	N	NO VISIBLE GOLD									
99DST202	N	NO VISIBLE GOLD									
99DST203	N	NO VISIBLE GOLD									
99DST204	N	NO VISIBLE GOLD									
99DST205	N	NO VISIBLE GOLD									
99DST206	N	NO VISIBLE GOLD									

Sample	Panned	Dimensions (microns)		Number of Visible Gold Grains			
Number	Y/N	Thickness		Reshaped	Modified	Pristine	Total
00DST01	No	NO VISIBLE GOLD					
00DST02	No	NO VISIBLE GOLD					
00DST03	No	50X50	10.25C	2			2
			total:	2			2
00DST04	No	NO VISIBLE GOLD					
00DST05	No	NO VISIBLE GOLD					
00DST06	No	NO VISIBLE GOLD					
00DST07	No	NO VISIBLE GOLD					
00DST08	No	NO VISIBLE GOLD					
00DST09	No	NO VISIBLE GOLD					
00DST10	No	NO VISIBLE GOLD					
00DST11	No	NO VISIBLE GOLD					
00DST12	No	NO VISIBLE GOLD					
00DST13	No	NO VISIBLE GOLD					
00DST14	No	NO VISIBLE GOLD					
00DST15	No	NO VISIBLE GOLD					
00DST16	No	NO VISIBLE GOLD					
00DST17	No	NO VISIBLE GOLD					

Sample	Panned	Dimensions (microns)		Number of Visible Gold Grains			
Number	Y/N	Thickness		Reshaped	Modified	Pristine	Total
00DST18	No	NO VISIBLE GOLD					
00DST100	No	NO VISIBLE GOLD					
00DST101	No	NO VISIBLE GOLD					
00DST102	No	NO VISIBLE GOLD					
00DST103	No	NO VISIBLE GOLD					
00DST104	No	25X50	7.7C	1			1
			total:				1
00DST105	No	NO VISIBLE GOLD					
00DST106	No	25X25	5.2C	1			1
			total:				1
00DST107	No	NO VISIBLE GOLD					
00DST108a	No	25X50	12.7C	1			1
			total:	1			1
00DST109	No	NO VISIBLE GOLD					
00DST110	No	NO VISIBLE GOLD					
00DST111	No	NO VISIBLE GOLD					
00DST112	No	25X50	7.7C	1	1		2
		50X75	12.7C	1			1
		100X150	24.7C	1			1
			total:	3	1		4

Sample	Panned	Dimensions (microns)		Number of Visible Gold Grains			
Number	Y/N	Thickness		Reshaped	Modified	Pristine	Total
00DST200	No	NO VISIBLE GOLD					
00DST201	No	25X25	5.2C	1			1
		25X50	7.7C	1			1
		50X50	10.3C	1			1
			total:	3			3
00DST202	No	NO VISIBLE GOLD					
00DST203	No	NO VISIBLE GOLD					
00DST204	No	NO VISIBLE GOLD					
00DST205a	No	NO VISIBLE GOLD					
00DST206	No	25X75	10.3C	1			1
			total:	1			1
00DST207	No	NO VISIBLE GOLD					
00DST208	No	50X75	12.7C	1			1
			total:	1			1
00DST210	No	25X50	7.7C	1			1
			total:	1			1
00DST211	No	NO VISIBLE GOLD					
00DST212	No	NO VISIBLE GOLD					
00DST213	No	NO VISIBLE GOLD					
00DST214	No	NO VISIBLE GOLD					

Sample	Panned	Dimensions (microns)			Number of Visible Gold Grains			
Number	Y/N	Thickness			Reshaped	Modified	Pristine	Total
00DST215	No	25X25	5.2C		2			2
		25X75	10.3C		1			1
		50X50	10.3C		2			2
			total:		5			5
00DST216	No	20X75		20	1			1
			total:		1			1
00DST400	No	NO VISIBLE GOLD						

C - Thickness calculated as 20% of mean diameter for 100 micron size. As diameter increases, the calculated thickness also increases but at a slower rate.
M - measured thickness; T - tabling stage grain shape determination; P - panning stage grain shape determination

Table 5: Metamorphosed Magmatic Sulphide Indicator Minerals

		Mg/Mn/Al/Cr minerals										Sulphide/Arsenide minerals .25-.5 mm					
		>1 amp					8-1 amp	< 8 amp				8-1 amp	>1 amp				
Sample	Total prime MMSIM grains	% Ky	% Sil	% Rt	Spinel	Other	% St	% Fay	% Opx	% Cr	%Sps	% Gth	% Py	% Ccp	Other	Lo Cr diop	Other
95DST22	0	0.5	0	0	tr	0	tr	tr	0	0	0	0	tr	0	0	n/a	
95DST23	1	tr	0	0	0	0	tr	0	0	0	0	0	tr	tr	0	n/a	
95DST24	1	0.5	0	0	tr	0	tr	0	0	0	0	0	0	tr	0	n/a	
95DST25	0	tr	0	0	tr	0	tr	0	0	0	0	0	0	0	0	n/a	
95DST26	0	0	0	0	0	0	tr	0	0	0	0	0	0	0	0	n/a	
95DST27	3	0.5	0	0	tr	0	tr	0	tr	0	0	tr	0.1	tr	0	n/a	
95DST28	18	0.5	0	0	tr	0	tr	tr	tr	0	0	0	5	0.1	0	n/a	
95DST29	0	0.5	0	0	0	0	tr	0	0	0	0	tr	0	0	0	n/a	
95DST30	8	1	0	tr	tr	0	tr	0	tr	0	0	0	tr	tr	0	n/a	
95DST120	5	0.5	0	0	0	0	tr	0	tr	0	0	0	0.2	tr	0	n/a	
95DST121	2	0.5	0	0	0	0	tr	0	tr	0	0	tr	tr	tr	0	n/a	
95DST122	1	1	0	0	0	0	tr	tr	tr	0	0	0	0.2	tr	0	n/a	
95DST123	0	2	0	0	0	0	tr	tr	0.5	0	0	0	0	0	0	n/a	
95DST204	0	tr	0	0	0	0	tr	0	0	0	0	tr	0	0	0	n/a	
95DST205	1	tr	0	0	0	0	tr	0	tr	0	0	0	tr	tr	0	n/a	
95DST206	1	tr	0	0	0	0	tr	0	tr	0	0	tr	0.2	tr	0	n/a	
95DST207	4	1	0	0	tr	tr Pim	tr	0	tr	0	0	0	tr	0	tr ruby	n/a	
95DST208	12	2	0	0	tr	tr Pim	tr	0	tr	0	0	0	tr	tr	0	n/a	
95DST209	3	0.5	0	0	tr	tr Spr	tr	tr	tr	0	0	0	0	tr	0	n/a	
95DST210	1	tr	0	0	0	0	tr	0	tr	0	0	tr	tr	tr	0	n/a	
96DST01	6	5	0	0	tr	tr Tur	1	0	0.5	tr	0	tr	3	tr	tr Apy	0	tr Cr-grs
96DST02	5	4	0	0	tr	0	1	0	tr	0	0	0	3	0.1	0	0	
96DST03	16	3	0	tr	tr gahnite	0	5	0	0.5	tr	0	0	2	tr	tr Apy	tr	
96DST04	0	0	0	0	0	0	0	0	tr	0	0	1	0	0	0	0	
96DST05	7	1	0	0	0	tr ruby	tr	0	0.5	0	0	0	tr	tr	tr moly	tr	tr Spr
96DST100	42	0.5	0	0	tr gahnite	tr Pim	tr	0	1	0	0	tr	5	0.5	tr Asp	0	tr Cr-grs
96DST101	0	tr	0	0	tr	0	tr	0	tr	0	0	tr	0	0	0	0	
96DST102	6	2	tr	0	tr	tr Pim	tr	0	1	0	0	0	tr	tr	0	tr	tr And
96DST103	1	0.5	0	0	tr	0	tr	0	tr	0	0	tr	0	tr	0	0	
96DST201	20	2	0	0	tr	0	0.5	0	tr	0	0	tr	tr	tr	0	tr	
96DST202	5	0.5	0	0	0	0	tr	0	tr	tr	0	1	tr	tr	0	tr	
96DST203	0	2	0	0	0	0	tr	0	3	0	0	tr	0	0	0	0	
97DST01	14	1	0	0	tr	tr Pim	tr	0	tr	0	0	0	tr	tr	tr Loel	tr	
97DST02	1	1	tr	0	tr	0	tr	0	1	0	0	0.5	0	0	0	tr	
97DST03	0	1	0	0	0	0	0	0	2	0	0	0.5	tr	0	0	0	
97DST04	29	tr	0	0	0	0	tr	0	tr	0	0	0	10	tr	tr moly	tr	
97DST05	44	2	tr	0	tr	tr Spr, Pim	tr	tr	3	0	0	0	0	tr	0	tr	
97DST06	7	10	0	tr	tr	0	2	0	0.5	0	0	3	1	0	0	tr	
97DST07	5	2	0	tr	tr	0	0.5	0	2	0	0	0.5	1	tr	0	tr	
97DST08	1	3	0	0	1	0	tr	0	1	0	0	5	0.5	0	0	tr	
97DST09	7	5	0	tr	tr	tr ruby	0.5	0	3	0	0	6	tr	tr	0	tr	
97DST100	6	5	tr	0	tr	tr Pim	0.5	0	4	0	0	tr	0	0	0	tr	
97DST101	15	4	tr	tr	tr	tr Pim	tr	0	3	0	0	tr	tr	tr	tr moly	tr	
97DST102	19	5	tr	0	tr gahnite	tr Pim	tr	0	3	0	0	0	0	tr	0	tr	
97DST103	58	5	tr	0	tr gahnite	tr Pim	tr	0	3	0	0	tr	0	0	0	tr	
97DST104	2	1	tr	0	0	0	tr	0	1	0	0	0.5	0	0	0	tr	
97DST105	17	3	0	tr	tr	tr Pim	1	0	tr	tr	0	tr	tr	tr	0	tr	
97DST106	0	tr	0	0	0	0	0	0	tr	0	0	0	tr	0	0	0	
97DST107	1	0.5	tr	0	0	0	tr	0	1	0	0	tr	0	0	0	tr	
97DST108	15	1	0	tr	tr	tr ruby	tr	0	3	tr	0	tr	0	0	0	tr	
97DST109	0	tr	0	0	0	0	tr	0	tr	0	0	3	5	0	0	0	

		Mg/Mn/Al/Cr minerals											Sulphide/Arsenide minerals .25-.5 mm				
		>1 amp					.8-1 amp	<.8 amp				.8-1 amp	>1 amp				
Sample	Total prime MMSIM grains	% Ky	% Sil	% Rt	Spinel	Other	% St	% Fay	% Opx	% Cr	% Sps	% Gth	% Py	% Ccp	Other	Lo Cr diop	Other
97DST110	4	5	0	0	tr	tr Pim	tr	0	1	0	0	tr	0	0	0	tr	
98DST01	2	3	0	0	0	0	tr	0	tr	0	0	tr	tr	tr	0	0	
98DST02	6	1	0	0	0	tr ruby	tr	0	tr	0	0	0	2	tr	0	tr	
98DST03	0	2	0	0	0	0	0.5	0	7	0	0	tr	1	0	0	0	1 Forsterite
98DST04	3	tr	0	tr	0	0	tr	0	1	tr	tr	6	4	tr	0	0	
98DST05	0	tr	0	0	0	0	0	0	tr	0	0	1	tr	0	0	0	
98DST07	0	tr	0	0	tr	0	tr	tr	tr	0	0	5	0	0	0	0	
98DST100	5	tr	0	0	tr	0	tr	0	tr	0	0	0	0.5	tr	0	tr	
98DST101	0	1	0	0	0	0	tr	tr	1	0	0	0	tr	0	0	0	
98DST102	1	tr	0	0	tr	0	0	0	0	0	0	0	0	0	0	tr	
98DST105	1	tr	0	0	0	0	tr	0	1	0	0	0	tr	tr	0	0	
98DST300	2	2	0	0	tr	0	tr	tr	tr	0	0	0	0	0	0	tr	
98DST301	3	3	0	0	tr	tr ruby	tr	0	0	0	0	0	tr	tr	tr moly	0	
98DST302	84	tr	0	0	tr	0	tr	0	2	0	0	0	5	0.2	0	tr	
98DST303	4	2	0	0	tr	tr ruby	1	0	5	0	0	0	0	tr	tr Cr-grs	tr	
98DST304	4	3	0	0	0	0	tr	tr	3	0	0	0	0	tr	0	tr	
99DST02	2	1	tr	0	0	tr ruby	tr	0	3	0	2	0	tr	tr	0	0	
99DST04	2	1	tr	tr	0	0	0	0	0	0	tr	0	0	0	0	tr	
99DST029	2	0.5	0	tr	0	0	tr	0	2	tr	tr	tr	0	0	0	0	
99DST32	1	2	tr	tr	tr	0	tr	0	5	0	1	4	1	0	0	0	
99DST33	1	2	0	0	0	tr topaz	tr	0	tr	0	tr	tr	0.5	0	0	tr	
99DST34	1	1	1	0	0	0	tr	0	3	0	tr	10	5	0	0	0	
99DST35	0	2	0	0	tr	0	tr	0	7	0	tr	3	10	0	0	0	
99DST36	2	1	0	tr	0	0	tr	0	5	tr	4	2	tr	0	0	0	
99DST37	0	1	tr	0	tr	0	tr	0	1	tr	0.5	tr	tr	0	0	0	
99DST38	6	2	tr	tr	tr	0	tr	0	7	0	1	3	tr	0	0	tr	
99DST39	4	5	tr	tr	tr	0	tr	tr	4	tr	0.5	1	tr	0	0	0	
99DST40	0	tr	0	0	0	0	0	0	tr	0	tr	tr	0	0	0	0	
99DST41	0	tr	0	0	0	0	0	0	1	0	tr	tr	tr	0	0	0	
99DST42	2	5	tr	0	0	0	tr	0	2	tr	tr	tr	tr	tr	0	0	
99DST43	56	3	tr	0	0	0	tr	0	15	tr	tr	1	tr	15	0	0	
99DST44	0	3	tr	0	0	0	tr	0	tr	tr	15	tr	tr	0	0	0	
99DST45	8	1	tr	0	tr	0	tr	0	3	tr	tr	tr	4	tr	tr moly	0	
99DST46	0	1	tr	0	0	0	tr	0	1	0	3	3	tr	0	0	0	
99DST47	1	1	0	0	tr gahnite	0	tr	0	3	0	1	3	tr	0	0	0	
99DST48	1	1	0	0	0	0	tr	0	1	0	tr	tr	0	0	tr moly	0	
99DST49	2	tr	0	0	tr gahnite	0	tr	0	tr	0	tr	tr	tr	tr	0	0	
99DST50	8	1	0	0	0	tr Pim	tr	0	1	0	tr	tr	0	tr	0	tr	
99DST100	4	tr	0	0	0	0	tr	0	0	0	0	0	4	tr	0	0	
99DST101	12	tr	0	0	0	0	tr	0	7	tr	3	tr	1	tr	0	0	
99DST102	3	1	0	0	tr gahnite	0	tr	0	35	0	0	tr	0	0	0	tr	
99DST104	0	tr	0	0	0	0	0	tr	5	0	tr	0	0.3	0	0	0	
99DST107	4	1	0	0	0	0	tr	0	3	0	0	tr	0	0	0	tr	
99DST124	2	1	0	tr	0	0	tr	0	tr	0	tr	tr	0	tr	0	0	
99DST200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
99DST201	3	1	0	0	tr	tr Pim	tr	0	20	0	tr	tr	0	0	0	tr	
99DST202	0	2	0	0	0	0	tr	0	15	0	tr	tr	0	0	0	0	
99DST203	0	2	0	0	0	0	tr	0	15	0	tr	tr	0	0	0	0	
99DST204	4	tr	0	0	0	tr Pim	tr	0	4	0	2	tr	tr	tr	0	0	
99DST205	0	2	0	tr	0	0	tr	0	3	0	tr	tr	tr	tr	0	0	
99DST206	2	2	0	0	0	0	tr	0	20	0	tr	tr	0	0	0	tr	

		Sulphide/Arsenide minerals .25-.5 mm			Mg/Mn/Al/Cr minerals .25 - .5 mm									
		>1.0 amp			<1. Amp	>1.0 amp						>.8 amp	<.8 amp	
							Misc. Prime MMSIMs							
Sample	Total prime MMSIM grains	% Ccp	% other	% Py	% Geo	% Spinel	% other	% rutile	% Ky	% Sil	% St	% Sps	% Opx	% Cr
00DST01	2	0	0	0	0	2 pale blue-green	Tr low-Cr-diopside (2 gr)	0	0.5	0	Tr	0	2	0
00DST02	1	0	0	Tr (5 gr)	Tr	0	Tr low-Cr diopside (1 gr)	0	0.5	0	Tr	0	3	0
00DST03	1	Tr (1 gr)	0	Tr (5 gr)	0	0	0	0	Tr	0	Tr	0	5	0
00DST04	0	0	0	Tr (1 gr)	Tr	0	0	0	Tr	0	Tr	0	2	0
00DST05	1	Tr (1 gr)	0	Tr (8 gr)	Tr	0	0	0	0.5	0	Tr	0	3	0
00DST06	2	Tr (2 gr)	0	Tr (7 gr)	Tr	0	0	0	0.5	0	0	0	Tr	0
00DST07	14	Tr (13 gr)	0	Tr (~30 gr)	Tr	3 pink	Tr ruby (1 gr)Tr low-Cr diopside	0	Tr	0	Tr	Tr	3	Tr (4 gr)
00DST08	14	Tr (10 gr)	0	Tr (~25 gr)	0	1 grn gahnite; 3 blue-green spin	Tr low-Cr diopside (2 gr)	0	Tr	0	Tr	0	Tr	Tr (1 gr)
00DST09	17	Tr (11 gr)	Tr moly (4)	0.5 (~100 gr)	0	1 grn gahnite; 1 blue-green spin	Tr low-Cr diopside (1 gr)	0	Tr	Tr	Tr	Tr	3	0
00DST10	3	Tr (3 gr)	0	Tr (7 gr)	0	1 pink	0	0	Tr	0	0	Tr	5	0
00DST11	0	0	0	5 (~200 gr)	0	0	0	0	0	0	0	0	0	0
00DST12	0	0	0	0.5 (~25 gr)	0	1 blue-green	0	0	Tr	Tr	Tr	0	0	0
00DST13	0	0	0	0	0	0	0	0	2	0	Tr	0	10	0
00DST14	4	Tr (2 gr)	0	Tr (5 gr)	Tr	1 pale blue	Tr ruby corundum (1 gr); 1 Pim	0	2	0	Tr	0	3	0
00DST15	0	0	0	Tr (~10 gr)	2	1 purple	0	0	2	0	0	0	3	0
00DST16	1	0	0	0	0	2 pink, pale blue	Tr ruby corundum (1 gr)	0	1	0	Tr	0	2	Tr (6 gr)
00DST17	3	0	0	0	0	0	Tr Pim (2) Tr low-Cr diopside (1)	0	1	0	Tr	0	3	0
00DST18	2	0	0	0	0	2 blue-green, colourless	Tr low-Cr diopside (2 gr)	0	1	0	0	0	1	0
00DST100	3	Tr (2 gr)	0	Tr (2 gr)	Tr	0	Tr low-Cr diopside (1 gr)	0	0.5	0	0	Tr	1	Tr (1 gr)
00DST101	1	tr (1 gr)	0	Tr (10 gr)	0	0	0	0	Tr	0	0	0	Tr	0
00DST102	1	Tr (1 gr)	0	0	0	2 pink	0	0	0.5	0	Tr	0	1	0
00DST103	50	0.5 (~75 gr)	0	10 (~1500 gr)	0	0	0	0	Tr	0	0	0	0	0
00DST104	0	0	0	Tr (~15 gr)	Tr	0	0	0	Tr	0	0	Tr	3	0
00DST105	0	0	0	1 (~50 gr)	Tr	0	0	0	0	0	0	0	0	0
00DST106	0	0	0	0	Tr	0	0	0	1	0	0	0	3	0
00DST107	0	0	0	Tr (~15 gr)	Tr	0	0	0	1	0	0	0	3	0
00DST108a	15	Tr (8 gr)	Tr moly (1)	0	0	2 blue-green, pale blue	Tr Spr (1) Tr low-Cr diop (5)	0	0.5	0	Tr	1	3	Tr (1 gr)
00DST109	0	0	0	0	0.5	0	0	0	Tr	Tr	0	0	2	0
00DST110	0	0	0	0	0	2 purple, blue-green	0	0	Tr	Tr	Tr	0	1	Tr (1 gr)
00DST111	0	0	0	0	0	2 pink	0	0	Tr	Tr	Tr	0	1	0
00DST112	3	Tr (2 gr)	0	Tr (~15 gr)	0	2 blue-green, pale blue	Tr low-Cr diopside (1 gr)	0	Tr	0	Tr	0	2	Tr (1 gr)
00DST200	0	0	0	0	Tr	2 pale blue, purple	0	0	Tr	Tr	0	Tr	5	Tr (1 gr)
00DST201	1	0	0	Tr (~20 gr)	0.5	1 purple	Tr low-Cr diopside (1 gr)	0	Tr	0	0	0	3	Tr (1 gr)
00DST202	6	Tr (5 gr)	0	Tr (~20 gr)	Tr	2 blue-green	Tr low-Cr diopside (1 gr)	0	Tr	0	0	Tr	2	Tr (1 gr)
00DST203	1	0	0	0	Tr	1 blue-green	Tr Mn-epidote (1 gr)	0	1	Tr	Tr	0	5	0
00DST204	0	0	0	Tr (2 gr)	0	1 pale blue	0	0	0	0	0	0	Tr	0
00DST205a	4	0	0	0	0	2 pale blue, pale pink	1 gr Spr, 1 gr ruby, 2 low-Cr diop	0	1	0	0	0	2	0
00DST206	25	Tr (20 gr)	0	Tr (~40 gr)	0	9 pale purple, pale green, grey	2 gr Pim, 1 gr ruby, 2 low-Cr diop	0	Tr	0	0.5	0	1	Tr (4 gr)
00DST207	9	Tr (7 gr)	tr moly (1)	2 (~300 gr)	0	0	Tr low-Cr diopside (1 gr)	0	Tr	0	0	0	0	0
00DST208	2	Tr (2 gr)	0	0	Tr	0	0	0	0	0	0	0	0	0
00DST210	1	0	0	0	0	0	0	Tr (1 gr)	0	0	0	0	Tr	0
00DST211	0	0	0	Tr (~15 gr)	Tr	2 purple	0	0	Tr	Tr	Tr	0	1	0
00DST212	0	0	0	0	0	0	0	0	Tr	0	0	0	Tr	Tr (2 gr)
00DST213	0	0	0	0	Tr	0	0	0	0	0	0	0	2	0
00DST214	0	0	0	0	Tr	0	0	0	0	Tr	0	0	2	0
00DST215	0	0	0	0	0	0	1 perovskite	0	0	0	0	0	2	Tr
00DST216	3	Tr(2 gr)	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	5	0
00DST400	7	Tr (5 gr)	0	0.5 (~100 gr)	0	3 pale blue	Tr low-Cr diopside (2 gr)	0	0.5	0	0	0	2	0

Notes: Mineral abbreviations are from Kretz (1983); Lo Cr diop = low-chrome diopside; Pim = piemontite; ruby = ruby corundum; Cr-grs = chrome grossular; moly = molybdenite; Loel = loellingite
Ky = kyanite; Sil = sillimanite; Rt = rutile; Fay = fayalite; Opx = orthopyroxene; Cr = chromite; Sps = spessartine; Gth = goethite; Py = pyrite; Ccp = chalcopyrite
Tr or tr normally indicates that from 1 to 10 grains and commonly 1 or 2 grains of the mineral species are observed in the concentrate
Total Prime MMSIM grains indicates the total number of picked grains of chalcopyrite, other sulphides such as molybdenite, gahnite, Mn-epidote, ruby corundum, low Cr-diopside and red rutile

Table 6: Kimberlite indicator mineral counts

	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm						
Sample Numl	GP	GO	DC	IM	CR	FO*	GP	GO	DC	IM	CR	FO*	GP	GO*	DC	IM*	CR	FO*	Total KIMs	Lo Cr Di
95DST022	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST023	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST024	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST024b	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST025	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	2		0		n/d	n/a	2	n/a
95DST025b	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	1		0		n/d	n/a	1	n/a
95DST026	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST027	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST028	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST029	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST030	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	2		1		n/d	n/a	3	n/a
95DST30b	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST120	n/d	n/d	n/d	n/d	n/d		0	0	0	1	0	n/d	1		0		n/d	n/a	2	n/a
95DST120b	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST121	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		1		n/d	n/a	1	n/a
95DST121b	n/d	n/d	n/d	n/d	n/d		0	0	0	0	6	n/d	1		0		n/d	n/a	7	n/a
95DST122	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	1		0		n/d	n/a	1	n/a
95DST123	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST204	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST205	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST206	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
95DST207b	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	3		0		n/d	n/a	3	n/a
95DST208b	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	8		2		n/d	n/a	10	n/a
95DST209	n/d	n/d	n/d	n/d	n/d		1	0	0	0	0	n/d	1		0		n/d	n/a	2	n/a
95DST209b	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	5		0		n/d	n/a	5	n/a
95DST210	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
96DST01	0	0	0	0	0		0	0	0	0	1	n/d	1		0		n/d	n/a	2	n/a
96DST02	0	0	0	0	0		0	0	0	1	0	n/d	0		0		n/d	n/a	1	n/a
96DST03	0	0	0	0	0		0	0	0	1	7	n/d	0		0		n/d	n/a	8	n/a
96DST04	0	0	0	0	0		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
96DST05	0	0	0	0	0		0	0	0	0	0	n/d	1		0		n/d	n/a	1	n/a
96DST100	0	0	0	0	0		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
96DST101	0	0	0	0	0		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
96DST102	0	0	0	0	0		1	0	0	0	0	n/d	0		0		n/d	n/a	1	n/a
96DST103	0	0	0	0	0		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
96DST201	0	0	0	0	0		0	0	0	1	0	n/d	1		0		n/d	n/a	2	n/a
96DST202	0	0	0	0	0		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a

	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm							
Sample Num	GP	GO	DC	IM	CR	FO*	GP	GO	DC	IM	CR	FO*	GP	GO*	DC	IM*	CR	FO*	Total KIMs	Lo Cr Di
96DST203	0	0	0	0	0		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
97DST01	n/d	n/d	n/d	n/d	n/d		0	0	0	1	0	n/d	0		0		n/d	n/a	1	n/a
97DST02	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	1		1		n/d	n/a	2	n/a
97DST03	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
97DST04	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
97DST05	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	4		1		n/d	n/a	5	n/a
97DST06	n/d	n/d	n/d	n/d	n/d		0	0	0	1	0	n/d	0		0		n/d	n/a	1	n/a
97DST07	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		1		n/d	n/a	1	n/a
97DST08	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
97DST09	n/d	n/d	n/d	n/d	n/d		0	2	0	0	0	n/d	0		0		n/d	n/a	2	n/a
97DST100	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	3		1		n/d	n/a	4	n/a
97DST101	n/d	n/d	n/d	n/d	n/d		0	2	0	3	0	n/d	0		0		n/d	n/a	5	n/a
97DST102	n/d	n/d	n/d	n/d	n/d		0	1	0	1	0	n/d	2		0		n/d	n/a	4	n/a
97DST103	n/d	n/d	n/d	n/d	n/d		6	0	0	6	1	n/d	12		7		n/d	n/a	32	n/a
97DST104	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
97DST105	n/d	n/d	n/d	n/d	n/d		0	0	0	2	0	n/d	12		0		n/d	n/a	14	n/a
97DST106	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
97DST107	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
97DST108	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	1		0		n/d	n/a	1	n/a
97DST109	n/d	n/d	n/d	n/d	n/d		0	0	0	0	0	n/d	0		0		n/d	n/a	0	n/a
97DST110	n/d	n/d	n/d	n/d	n/d		0	1	0	0	0	n/d	0		0		n/d	n/a	1	n/a
98 DST01	0	0	0	0	0		0	0	0	0	0	0	0		0		0	n/a	0	n/a
98DST02	0	0	0	0	0		0	0	0	0	1	0	0		0		0	n/a	1	n/a
98DST03	0	0	0	0	0		0	0	0	0	0	1	0		0		0	n/a	1	n/a
98DST04	0	0	0	1	0		0	0	0	1	0	0	0		0		1	n/a	3	n/a
98DST05	0	0	0	0	0		0	0	0	0	0	0	0		1		0	n/a	1	n/a
98DST07	0	0	0	0	0		0	0	0	0	0	0	0		0		0	n/a	0	n/a
98DST100	0	0	0	0	0		0	0	0	0	0	0	2		0		0	n/a	2	n/a
98DST101	0	0	0	0	0		0	0	0	0	0	0	0		0		0	n/a	0	n/a
98DST102	0	0	0	0	0		0	0	0	2	1	0	2		1		1	n/a	7	n/a
98DST105	0	0	0	0	0		0	0	0	0	0	0	0		2		0	n/a	2	n/a
98DST300	0	0	0	0	0		0	0	0	0	1	0	1		2		0	n/a	4	n/a
98DST301	0	0	0	0	0		0	0	0	0	0	0	1		2		0	n/a	3	n/a
98DST302	0	0	0	1	0		0	0	0	0	0	0	0		0		0	n/a	1	n/a
98DST303	0	0	0	0	0		0	0	0	0	0	0	1		0		0	n/a	1	n/a
98DST304	0	0	0	0	0		0	0	0	0	0	0	0		0		0	n/a	0	n/a
99DST02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
99DST03	picked for Au grains only																		0	
99DST04	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	2	0	0	6	1

	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm							
Sample Numl	GP	GO	DC	IM	CR	FO*	GP	GO	DC	IM	CR	FO*	GP	GO*	DC	IM*	CR	FO*	Total KIMs	Lo Cr Di
99DST05	picked for Au grains only																			
99DST06	picked for Au grains only																			
99DST07	picked for Au grains only																			
99DST08	picked for Au grains only																			
99DST09	picked for Au grains only																			
99DST10	picked for Au grains only																			
99DST11	picked for Au grains only																			
99DST12	picked for Au grains only																			
99DST13	picked for Au grains only																			
99DST14	picked for Au grains only																			
99DST15	picked for Au grains only																			
99DST16	picked for Au grains only																			
99DST17	picked for Au grains only																			
99DST18	picked for Au grains only																			
99DST19	picked for Au grains only																			
99DST20	picked for Au grains only																			
99DST21	picked for Au grains only																			
99DST22	picked for Au grains only																			
99DST23	picked for Au grains only																			
99DST24	picked for Au grains only																			
99DST25	picked for Au grains only																			
99DST26	picked for Au grains only																			
99DST27	picked for Au grains only																			
99DST28	picked for Au grains only																			
99DST29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0
99DST30	picked for Au grains only																			
99DST31	picked for Au grains only																			
99DST32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
99DST34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
99DST37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
99DST38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
99DST39	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	0
99DST40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST42	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2	0	4	0
99DST43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0

	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm							
Sample Num	GP	GO	DC	IM	CR	FO*	GP	GO	DC	IM	CR	FO*	GP	GO*	DC	IM*	CR	FO*	Total KIMs	Lo Cr Di
99DST44	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	3	0
99DST45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
99DST46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST48	0	0	0	0	0	0	0	0	0	2	0	0	10	0	0	0	0	0	12	0
99DST49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
99DST100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0
99DST102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
99DST103	picked for Au grains only																			
99DST104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
99DST105	picked for Au grains only																			
99DST106	picked for Au grains only																			
99DST107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
99DST108	picked for Au grains only																			
99DST109	picked for Au grains only																			
99DST110	picked for Au grains only																			
99DST111	picked for Au grains only																			
99DST112	picked for Au grains only																			
99DST113	picked for Au grains only																			
99DST114	picked for Au grains only																			
99DST115	picked for Au grains only																			
99DST116	picked for Au grains only																			
99DST117	picked for Au grains only																			
99DST118	picked for Au grains only																			
99DST119	picked for Au grains only																			
99DST120	picked for Au grains only																			
99DST121	picked for Au grains only																			
99DST122	picked for Au grains only																			
99DST123	picked for Au grains only																			
99DST124	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	0
99DST200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST201	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
99DST202	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2	0
99DST203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
99DST205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99DST206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm							
Sample Num	GP	GO	DC	IM	CR	FO*	GP	GO	DC	IM	CR	FO*	GP	GO*	DC	IM*	CR	FO*	Total KIMs	Lo Cr Di
00DST01	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
00DST02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
00DST03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST07	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
00DST08	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	4	0	5	1
00DST09	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2	2
00DST10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
00DST11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST16	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	6	0	9	0
00DST17	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
00DST18	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2
00DST100	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2	1
00DST101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST108a-e	1	0	0	2	0	1	4	1	1	53	2	24	57	2	6	54	7	55	282	5
00DST109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0
00DST111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	1
00DST200	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2	0
00DST201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
00DST202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	1
00DST203	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
00DST204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST205a	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	0	4	2
00DST206	0	0	0	0	0	0	0	0	0	1	1	0	2	0	0	2	4	1	11	2
00DST207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm							
Sample Numl	GP	GO	DC	IM	CR	FO*	GP	GO	DC	IM	CR	FO*	GP	GO*	DC	IM*	CR	FO*	Total KIMs	Lo Cr Di
00DST208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST210	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
00DST211	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
00DST212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0
00DST213	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00DST216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
00DST400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
																		grand total	527	
Notes: n/d not detected; n/a not applicable (the concentrate was not examined for this mineral) * denotes minerals that were not rigorously picked.																				
GP-pyrope garnet, GO eclogitic garnet, DC chrome diopside, IM ilmenite, CR chromite, FO foresterite, Lo Cr Di Low Chrome Diopside																				

Table 7: Heavy mineral picking remarks.

Sample Number	Picking Remarks
95DST022	Equally mixed greenschist and amphibolite facies supracrustal assemblages. SEM check spinel from 0.25-0.5 mm = no Zn
95DST023	No remarks.
95DST024	SEM confirmed 1 splendant black IM candidate from 0.5-1.0 mm as picroilmenite (high Mg, high Cr).
95DST024b	No remarks.
95DST025	SEM confirmed 2 pale purple flawless GP candidates from 0.25-0.5 as G9 pyrope.
95DST025b	Also picked 2 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
95DST026	Very small concentrate.
95DST027	No remarks.
95DST028	No remarks.
95DST029	Picked 3 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
95DST030	SEM confirmed 2 pale purple flawless GP candidates from 0.25-0.5 as G9 pyrope.
95DST030b	Picked 3 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
95DST120	Also picked 1 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
95DST121	No remarks.
95DST121b	Also picked 1 pale emerald green low/very-Cr diopside from 0.25-0.5 mm fraction.
95DST122	No remarks.

Sample Number	Picking Remarks
95DST123	No remarks.
95DST204	No remarks.
95DST205	No remarks.
95DST206	Also picked 3 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
95DST207b	Also picked 17 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
95DST208b	Also picked 1 pale emerald green low/very low-Cr diopside from 0.5-1.0 mm fraction and 3 from 0.25-0.5 mm fraction.
95DST209	SEM check of 1 pale emerald green grain from 0.25-0.5 mm = very low Cr-Diopside. One of the 2 GP from 0.25-0.5 mm is very well rounded, recycled from Cretaceous sediments.
95DST209b	Also picked 1 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
95DST210	No remarks.
96DST01	SEM check from 0.5-1.0 mm fraction: 1 black CR candidate = 1 Cr. SEM checks from 0.25-0.5 mm fraction: 1 purple-red GP candidate = 1 G9 pyrope; and 7 Cr candidates = 5 Cr, 1 titanite and 1 titanomagnetite.
96DST02	SEM checks from 0.5-1.0 mm fraction: 4 IM candidates = 1 IM, 2 crustal imenite and 1 hornblende.
96DST03	SEM checks from 0.5-1.0 mm fraction: 10 octahedral Cr candidates = 1 IM, 7 Cr and 2 crustal ilmenite. SEM checks from 0.25-0.5 mm fraction: 11 Cr candidates = 10 Cr (1attached to enstatite) and 1 crustal ilmenite + bronzite. Also picked 4 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
96DST04	No remarks.
96DST05	Also picked 2 pale emerald green low-Cr diopside from 0.25-0.5 mm fraction.
96DST100	No remarks.

Sample Number	Picking Remarks
96DST101	No remarks.
96DST102	SEM check from 0.5-1.0 mm fraction: 1 Im candidate = 1 crustal ilmenite. Also picked 2 pale emerald green low-Cr diopside from 0.25-0.5 mm fraction.
96DST103	No remarks.
96DST201	SEM checks from 0.5-1.0 mm fraction: 2 IM candidates = 1 IM and 1 crustal ilmenite. Also picked 2 pale emerald green low-Cr diopside from 0.25-0.5 mm fraction.
96DST202	Picked 6 Cr and 1 pale emerald green low-Cr diopside from 0.25-0.5 mm fraction.
96DST203	No remarks.
97DST01	SEM checks from 0.5-1.0 mm fraction: 2 IM versus crustal ilmenite candidates = 1 IM and 1 crustal ilmenite. SEM check from 0.25-0.5 mm fraction: 1 GP versus spinel candidate = 1 spinel. Picked 1 pale emerald green low/very low-Cr diopside from 0.5-1.0 mm fraction and 2 from 0.25-0.5 mm fraction.
97DST02	SEM checks from 0.25-0.5 mm fraction: 2 GP versus almandine candidates = 2 GO (1 pyrope-almandine and 1 Cr-poor megacryst). Also picked 1 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST03	No remarks.
97DST04	SEM check from 0.5-1.0 mm fraction: 1 GP versus almandine candidate = 1 almandine. Picked 2 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST05	Oversized concentrate. SEM check from 0.5-1.0 mm fraction: 1 Cr versus tourmaline candidate = 1 tourmaline. SEM checks from 0.25-0.5 mm fraction: 7 GO versus almandine candidates = 1 GP, 4 GO (3 pyrope-almandine and 1 Cr-poor megacryst) and 2 almandine. Picked 3 additional GP from 0.25-0.5 mm fraction. Also picked 18 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST06	SEM checks from 0.5-1.0 mm fraction: 4 IM (weak MgO) amd 3 crustal ilmenite. Picked 1 pale emerald green low/very low-Cr diopside from 0.5-1.0 mm fraction and 3 from 0.25-0.5 mm fraction.

Sample Number	Picking Remarks
97DST07	SEM check from 0.5-1.0 mm fraction: 1 blue-purple GP versus spinel candidate = 1 spinel. Also picked 3 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST08	No remarks.
97DST09	SEM checks from 0.5-1.0 mm fraction: 4 GO versus almandine candidates = 2 GO (pyrope-almandine), 1 almandine and 1 staurolite; and 2 IM versus crustal ilmenite candidates = 2 crustal ilmenite. SEM checks from 0.25-0.5 mm fraction: 1 GO versus almandine candidate = 1 GO (Cr-poor megacryst). Picked 2 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST100	SEM checks from 0.25-0.5 mm fraction: 8 GO versus almandine candidates = 5 GO (1 Cr-poor megacryst and 4 pyrope-almandine) and 3 almandine. Also picked 4 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST101	SEM checks from 0.5-1.0 mm fraction: 8 GO versus almandine candidates = 2 GO (pyrope-almandine) and 6 almandine; and 3 IM versus crustal ilmenite candidates = 3 IM. SEM checks from 0.25-0.5 mm fraction; 9 GO versus almandine candidates = 3 GO (pyrope-almandine) and 6 almandine. Picked 5 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST102	SEM checks from 0.25-0.5 mm fraction: 1 deep purple-red GP candidate = 1 Mn-epidote; and 11 GO versus almandine candidates = 5 GO (4 pyrope-almandine and 1 Cr-poor megacryst), 3 epidote, 2 almandine and 1 staurolite. Also picked 11 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST103	Oversized concentrate. Picked 100 g out of a total of 236.3 g of 0.25-0.5 mm heavies. SEM checks from 0.5-1.0 mm fraction: 1 transluscent GP candidate = 1 GP; 1 colourless olivine candidate = 1 olivine (forsterite); and 18 IM versus crustal ilmenite = 5 IM, 1 Cr and 12 crustal ilmenite. Picked 5 additional GP and 1 additional IM from 0.5-1.0 mm fraction. SEM checks from 0.25-0.5 mm fraction: 4 GO versus almandine candidates = 3 GO (2 pyrope almandine and 1 Cr-poor megacryst) and 1 almandine. Also picked 29 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST104	Picked 2 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST105	SEM checks from 0.25-0.5 mm fraction: 12 GO versus almandine candidates = 4 GO (3 pyrope-almandine and 1 Cr-poor megacryst) 7 almandine and 1 staurolite. Also picked 2 Cr and 10 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
97DST106	No remarks.
97DST107	Picked 1 pale emerald green low/very lo-Cr diopside from 0.25-0.5 mm fraction.

Sample Number	Picking Remarks
97DST108	SEM checks from 0.25-0.5 mm fraction: 2 pale red-purple GP versus almandine candidates = 1 GP and 1 Mg almandine. Also picked 4 pale emerald green low/very low-Cr diopside and 1 Cr from 0.25-0.5 mm fraction.
97DST109	No remarks.
97DST110	SEM checks from 0.5-1.0 mm fraction: 1 GO versus almandine candidate = 1 GO (pyrope-almandine). Picked 2 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
98DST02	SEM checks from 0.5-1.0 mm fraction: 2 IM versus crustal ilmenite candidates = 1 CR and 1 crustal ilmenite. SEM checks from 0.25-0.5 mm fraction: 1 GP versus ruby corundum candidate = 1 ruby corundum (picked as MMSIM). Also picked 1 pale emerald green low/very low- Cr diopside from 0.5-1.0 mm fraction and 1 other from 0.25-0.5 mm fraction.
98DST03	SEM check from 0.5-1.0 mm fraction: 1 forsterite olivine versus epidote candidate = 1 forsterite olivine. SEM check from 0.25-0.5 mm fraction: 2 CR versus crustal ilmenite candidates = 2 crustal ilmenite.
98DST04	SEM check from 1.0-2.0 mm fraction: 1 IM versus crustal ilmenite candidate = 1 IM. SEM checks from 0.5-1.0 mm fraction: 3 IM versus crustal ilmenite candidates = 1 IM and 2 rutile. SEM checks from 0.25-0.5 mm fraction: 1 IM versus crustal ilmenite candidate = 1 IM; and 9 rounded semi-octahedral CR candidates = 1 CR, 4 Fe-oxide, 3 tourmaline and 1 titanomagnetite.
98DST05	SEM check from 0.25-0.5 mm fraction: 1 DC versus Cr-grossular candidate = 1 DC.
98DST07	SEM check from 0.25-0.5 mm fraction: 1 IM versus crustal ilmenite candidate = 1 IM.
98DST100	SEM check from 0.25-0.5 mm fraction: 3 GO versus almandine candidates = 1 GO (Cr-poor megacryst) and 2 almandine. Also picked 2 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
98DST102	SEM checks from 0.5-1.0 mm fraction: 3 IM versus crustal ilmenite candidates = 2 IM and 1 CR. SEM check from 0.25-0.5 mm fraction: 1 CR versus crustal ilmenite candidate = 1 CR. Also picked 1 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction. Lost 1 GP from 0.25-0.5 mm fraction.
98DST300	Also picked 2 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
98DST302	SEM check from 0.25-0.5 mm fraction: 1 IM versus crustal ilmenite candidate = 1 crustal ilmenite. Also picked 1 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.

Sample Number	Picking Remarks
98DST303	Also picked 1 pale emerald green low/very low-Cr diopside from 0.25-0.5 mm fraction.
98DST304	Picked 3 pale emerald green low/very llow-Cr diopside from 0.25-0.5 mm fraction.
99DST01	No KIM remarks.
99DST02	SEM check from 0.25-0.5 mm fraction: 1 CR versus crustal ilmenite candidate = 1 IM.
99DST04	SEM checks from 0.5-1.0 mm fraction: 3 IM versus CR candidates = 2 IM and 1 CR. SEM checks from 0.25-0.5 mm fraction: 6 IM versus CR candidates = 2 IM and 4 crustal ilmenite.
99DST29	SEM checks from 0.25-0.5 mm fraction: 4 IM versus CR candidates = 1 IM, 1 CR, 1 crustal ilmenite and 1 tourmaline.
99DST32	No KIM remarks.
99DST33	SEM check from 0.25-0.5 mm fraction: 1GP versus zircon candidate = 1 zircon.
99DST34	No KIM remarks.
99DST35	No KIM remarks.
99DST36	No KIM remarks.
99DST37	SEM check from 0.25 -0.5 mm fraction: 1 CR versus crustal ilmenite candidate = 1 CR.
99DST38	No KIM remarks.
99DST39	SEM check from 0.25-0.5 mm fraction: 2 CR versus crustal ilmenite candidate= 1 CR and 1 crustal ilmenite.
99DST40	No KIM remarks.
99DST41	No KIM remarks.
99DST42	SEM check from 0.5 to 1.0 mm fraction: 1 IM versus crustal ilmenite candidate = 1 IM. SEM check from 0.25-0.5 mm fraction: 1 GO versus almandine candidate = 1 GO (Cr-poor megacryst).

Sample Number	Picking Remarks
99DST43	No KIM remarks.
99DST44	No KIM remarks.
99DST45	No KIM remarks.
99DST46	No KIM remarks.
99DST47	No KIM remarks.
99DST48	No KIM remarks.
99DST49	No KIM remarks.
99DST50	No KIM remarks.
99DST100	No KIM remarks.
99DST101	No KIM remarks.
99DST102	No KIM remarks.
99DST104	SEM checks from 0.25-0.5 mm fraction: 3 IM versus crustal ilmenite candidates = 1 IM and 2 crustal ilmenite.
99DST107	No KIM remarks.
99DST124	No KIM remarks.
99DST200	No KIM remarks.
99DST201	No KIM remarks.
99DST202	No KIM remarks.

Sample Number	Picking Remarks
99DST203	No KIM remarks.
99DST204	No KIM remarks.
99DST205	No KIM remarks.
99DST206	No KIM remarks.
00DST01	No KIM remarks.
00DST02	No KIM remarks.
00DST03	No KIM remarks.
00DST04	No KIM remarks.
00DST05	No KIM remarks.
00DST06	No KIM remarks.
00DST07	SEM checks from 0.25-0.5 mm fraction: 2 CR versus crustal ilmenite candidates = 2 CR; and 2 IM versus crustal ilmenite candidates = 1 IM and 1 crustal ilmenite.
00DST08	SEM check from 0.5-1.0 mm fraction: 1 CR versus tourmaline candidate = 1 CR. SEM check from 0.25-0.5 mm fraction: 1 CR versus tourmaline candidate = 1 CR.
00DST09	No KIM remarks.
00DST10	No KIM remarks.
00DST11	No KIM remarks.
00DST12	No KIM remarks.

Sample Number	Picking Remarks
00DST13	No KIM remarks.
00DST14	No KIM remarks.
00DST15	SEM check from 0.25-0.5 mm fraction: 1 IM versus crustal ilmenite candidate = 1 crustal ilmenite.
00DST16	SEM checks from 0.25-0.5 mm fraction: 2 CR versus IM candidates = 2 IM.
00DST17	No KIM remarks.
00DST18	SEM checks from 0.5-1.0 mm fraction: 3 IM versus crustal ilmenite candidates = 1 IM and 2 crustal ilmenite.
00DST100	SEM check from 0.25-0.5 mm fraction: 1 CR versus Ti-andradite candidate = 1 CR.
00DST101	SEM checks from 0.25-0.5 mm fraction: 2 CR versus crustal ilmenite candidates = 2 tourmaline.
00DST102	SEM checks from 0.25-0.5 mm fraction: 1 GO versus staurolite candidate = 1 staurolite; and 2 CR versus tourmlaine candidates = 2 tourmaline.
00DST103	No KIM remarks.
00DST104	No KIM remarks.
00DST105	No KIM remarks.
00DST106	No KIM remarks.
00DST107	No KIM remarks.
00DST108a	SEM checks from 0.5-1.0 mm fraction: 1 GO versus grossular candidate = 1 grossular; and 7 forsterite versus diopside candidates = 7 forsterite. Four 0.25-0.5 mm GP grains have partial kelyphite rind.
00DST109	SEM check from 0.25-0.5 mm fraction: 1 IM versus crustal ilmenite candidate = 1 crustal ilmenite.
00DST110	No KIM remarks.

Sample Number	Picking Remarks
00DST111	No KIM remarks.
00DST112	SEM check from 0.5-1.0 mm fraction: 1 IM versus crustal ilmenite candidate = 1 crustal ilmenite. SEM checks from 0.25-0.5 mm fraction: 6 IM versus crustal ilmenite candidates = 1 IM and 5 crustal ilmenite.
00DST200	SEM check from 0.25-0.5 mm fraction: 1 CR versus crustal ilmenite candidate = 1 CR.
00DST201	SEM check from 0.25-0.5 mm fraction: 1 CR versus crustal ilmenite candidate = 1 CR.
00DST202	SEM checks from 0.5-1.0 mm fraction: 1 GO versus almandine candidate = 1 spessartine and 4 IM versus crustal ilmenite candidates = 4 crustal ilmenite.
00DST203	SEM check from 0.5-1.0 mm fraction: 1 IM versus crustal ilmenite candidate = 1 IM. SEM checks from 0.25-0.5 mm fraction: 3 CR versus crustal ilmenite candidates = 3 crustal ilmenite.
00DST204	No KIM remarks.
00DST205a	SEM checks from 0.5-1.0 mm fraction: 1 GO versus almandine candidate = 1 GO (pyrope-almandine); and 4 IM versus crustal ilmenite candidates = 1 IM, 2 crustal ilmenite and 1 rutile. SEM checks from 0.25-0.5 mm fraction: 3 IM versus crustal ilmenite candidates= 2 IM and 1 crustal ilmenite.
00DST206	SEM checks from 0.25-0.5 mm fraction: 1 GP versus ruby corundum candidate = 1 GP; 2 GO versus staurolite candidates = 1 staurolite and 1 almandine; 3 IM versus crustal ilmenite candidates = 3 crustal ilmenite; and 1 forsterite versus diopside candidate = 1 forsterite.
00DST207	No KIM remarks.
00DST208	No KIM remarks.
00DST210	SEM check from 0.5-1.0 mm fraction: 1 IM versus crustal ilmenite candidate = 1 CR. SEM checks from 0.25-0.5 mm fraction: 2 IM versus crustal ilmenite candidates = 2 crustal ilmenite.
00DST211	No KIM remarks.

Sample Number	Picking Remarks
00DST212	SEM checks from 0.25-0.5 mm fraction: 6 CR versus titanomagnetite candidates = 2 CR and 4 crustal ilmenite.
00DST213	No KIM remarks.
00DST214	SEM check from 0.25-0.5 mm fraction: 1 forsterite versus diopside candidate = 1 diopside.
00DST215	SEM check from 0.25-0.5 mm fraction: 1 CR versus perovskite candidate = 1 perovskite.
00DST216	No KIM remarks.
00DST400	SEM check from 0.25-0.5 mm fraction: 1 CR versus crustal ilmenite candidate = 1 tourmaline.

Table 8: Mineral chemistry of MMSIM and KIM grains in surficial material and from minerals in known rock sources.

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
Gahnites															
00-DST-08-01	0.04	0.00	0.00	56.49	0.00	0.00	1.49	0.15	6.96	0.01	34.63	99.76	0.33	6.66	99.79
00-DST-09-01	0.03	0.01	0.04	54.37	0.00	0.00	0.01	0.38	7.75	0.01	36.16	98.76	1.19	6.68	98.88
99-DST-39-03	0.04	0.00	0.04	55.94	0.01	0.00	2.69	0.29	8.10	0.00	31.85	98.97	1.27	6.95	99.09
99-DST-49-01	0.03	0.03	0.01	56.37	0.00	0.01	2.21	0.21	9.95	0.01	30.51	99.33	0.85	9.18	99.42
99-DST-102-01	0.03	0.02	0.00	67.43	0.05	0.02	23.32	0.15	8.23	0.00	0.02	99.27	1.67	6.73	99.44

CR-DIOPSIDE ■ possible garnet-lherzolite affinity ▨ possible lherzolite affinity

Cr-Diopside, Cr_2O_3 wt % Values > 1											
Sample	**SiO2**	**TiO2**	**Al2O3**	**Cr2O3**	**MgO**	**CaO**	**MnO**	**FeO**	**Na2O**	**K2O**	**Total**
95dst120b-1di	53.02	0.19	2.62	1.35	18.12	18.93	0.13	4.40	0.62	0.00	99.38
95dst121b-1di	53.69	0.00	1.20	1.01	16.09	22.82	0.09	3.22	0.71	0.00	98.84
95dst207b-4di	53.98	0.04	0.89	1.23	15.04	22.86	0.18	4.38	0.92	0.00	99.52
95dst207b-6di	53.44	0.35	1.33	1.28	18.01	19.53	0.12	5.14	0.55	0.00	99.74
95dst208b-10di	54.83	0.11	0.24	1.73	16.44	22.58	0.05	2.34	1.35	0.01	99.68
95dst208b-16di	53.78	0.11	1.38	1.02	16.37	22.82	0.10	2.97	0.57	0.00	99.11
95dst208b-17di	54.01	0.15	1.02	1.08	16.56	23.34	0.06	2.43	0.78	0.00	98.50
95dst208b-19di	53.56	0.20	0.97	1.25	17.54	21.27	0.13	3.99	0.49	0.00	99.40
95dst208b-20di	53.25	0.03	1.81	1.03	15.24	22.61	0.20	4.44	0.71	0.00	99.33
95dst208b-23di	53.21	0.05	1.44	1.10	15.32	23.09	0.14	4.24	0.71	0.00	99.28
95dst209-8di	54.81	0.33	1.88	1.09	16.31	19.62	0.11	3.14	1.98	0.02	99.30
95dst30-28di	54.03	0.03	1.42	1.42	15.87	22.64	0.15	2.94	0.89	0.00	99.39
95dst30b-3di	52.80	0.03	2.42	1.06	15.75	23.15	0.13	3.40	0.53	0.00	99.24
[illegible]	52.23	0.10	4.20	1.33	14.58	22.50	0.10	3.67	0.91	0.00	99.62
97dst01-19di	53.31	0.26	1.26	1.34	17.89	18.85	0.13	5.32	0.63	0.01	99.00
97dst02-5di	54.89	0.09	1.08	3.01	15.34	19.82	0.08	2.50	2.44	0.01	99.26
97dst04-31di	52.82	0.44	2.08	1.22	17.11	21.97	0.11	3.78	0.26	0.00	99.79
97dst05-38di	54.89	0.28	5.03	1.28	14.60	14.55	0.13	4.42	4.07	0.01	99.27
97dst05-48di	53.26	0.03	2.44	1.15	16.20	23.49	0.09	2.94	0.55	0.00	100.15
97dst05-52di	53.32	0.35	1.17	1.23	17.47	20.29	0.13	5.23	0.47	0.01	99.67
97dst05-55di	53.26	0.37	1.08	1.09	17.36	20.63	0.11	5.17	0.43	0.00	99.50
97dst05-56di	53.11	0.42	1.20	1.30	17.30	20.71	0.14	4.73	0.47	0.00	99.39
97dst05-57di	53.36	0.26	1.17	1.18	18.01	19.55	0.10	5.37	0.52	0.00	99.52
97dst05-58di	55.12	0.29	5.40	1.04	14.90	13.58	0.12	4.60	4.31	0.02	99.36
97dst06-14di	53.64	0.00	1.56	1.04	16.22	21.26	0.10	4.27	0.76	0.00	98.86
97dst07-6di	53.69	0.18	1.69	1.04	15.32	22.78	0.13	4.23	0.74	0.00	99.80

+2 +15

+3

Table 8: Mineral chemistry of MMSIM and KIM grains in surficial material and from minerals in known rock sources.

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
Gahnites															
00-DST-08-01	0.04	0.00	0.00	56.49	0.00	0.00	1.49	0.15	6.96	0.01	34.63	99.76	0.33	6.66	99.79
00-DST-09-01	0.03	0.01	0.04	54.37	0.00	0.00	0.01	0.38	7.75	0.01	36.16	98.76	1.19	6.68	98.88
99-DST-39-03	0.04	0.00	0.04	55.94	0.01	0.00	2.69	0.29	8.10	0.00	31.85	98.97	1.27	6.95	99.09
99-DST-49-01	0.03	0.03	0.01	56.37	0.00	0.01	2.21	0.21	9.95	0.01	30.51	99.33	0.85	9.18	99.42
99-DST-102-01	0.03	0.02	0.00	67.43	0.05	0.02	23.32	0.15	8.23	0.00	0.02	99.27	1.67	6.73	99.44

CR-DIOPSIDE ■ possible garnet-lherzolite affinity ☐ possible lherzolite affinity

Cr-Diopside, Cr_2O_3 wt % Values > 1										
Sample	**SiO2**	**TiO2**	**Al2O3**	**Cr2O3**	**MgO**	**CaO**	**MnO**	**FeO**	**Na2O**	**K2O**	**Total**
95dst120b-1di	53.02	0.19	2.62	1.35	18.12	18.93	0.13	4.40	0.62	0.00	99.38
95dst121b-1di	53.69	0.00	1.20	1.01	16.09	22.82	0.09	3.22	0.71	0.00	98.84
95dst207b-4di	**53.98**	**0.04**	**0.89**	**1.23**	**15.04**	**22.86**	**0.18**	**4.38**	**0.92**	**0.00**	**99.52**
95dst207b-6di	53.44	0.35	1.33	1.28	18.01	19.53	0.12	5.14	0.55	0.00	99.74
95dst208b-10di	**54.83**	**0.11**	**0.24**	**1.73**	**16.44**	**22.58**	**0.05**	**2.34**	**1.35**	**0.01**	**99.68**
95dst208b-16di	53.78	0.11	1.38	1.02	16.37	22.82	0.10	2.97	0.57	0.00	99.11
95dst208b-17di	**54.01**	**0.15**	**1.02**	**1.08**	**16.66**	**23.34**	**0.06**	**2.43**	**0.76**	**0.00**	**99.50**
95dst208b-19di	53.56	0.20	0.97	1.25	17.54	21.27	0.13	3.99	0.49	0.00	99.40
95dst208b-20di	53.25	0.03	1.81	1.03	15.24	22.61	0.20	4.44	0.71	0.00	99.33
95dst208b-23di	53.21	0.05	1.44	1.10	15.32	23.09	0.14	4.24	0.71	0.00	99.28
95dst209-8di	54.81	0.33	1.88	1.09	16.31	19.62	0.11	3.14	1.98	0.02	99.30
95dst30-28di	**54.03**	**0.03**	**1.42**	**1.42**	**15.87**	**22.64**	**0.15**	**2.94**	**0.89**	**0.00**	**99.39**
95dst30b-3di	52.80	0.03	2.42	1.06	15.75	23.15	0.13	3.40	0.53	0.00	99.24
96dst03-50di	**52.23**	**0.10**	**4.26**	**1.33**	**14.53**	**22.50**	**0.10**	**3.67**	**0.91**	**0.00**	**99.62**
97dst01-19di	53.31	0.26	1.26	1.34	17.89	18.85	0.13	5.32	0.63	0.01	99.00
97dst02-5di	**54.89**	**0.09**	**1.08**	**3.01**	**15.34**	**19.82**	**0.08**	**2.50**	**2.44**	**0.01**	**99.26**
97dst04-31di	52.82	0.44	2.08	1.22	17.11	21.97	0.11	3.78	0.26	0.00	99.79
97dst05-38di	**54.89**	**0.28**	**5.03**	**1.28**	**14.60**	**14.55**	**0.13**	**4.42**	**4.07**	**0.01**	**99.27**
97dst05-48di	53.26	0.03	2.44	1.15	16.20	23.49	0.09	2.94	0.55	0.00	100.15
97dst05-52di	53.32	0.35	1.17	1.23	17.47	20.29	0.13	5.23	0.47	0.01	99.67
97dst05-55di	53.26	0.37	1.08	1.09	17.36	20.63	0.11	5.17	0.43	0.00	99.50
97dst05-56di	53.11	0.42	1.20	1.30	17.30	20.71	0.14	4.73	0.47	0.00	99.39
97dst05-57di	53.36	0.26	1.17	1.18	18.01	19.55	0.10	5.37	0.52	0.00	99.52
97dst05-58di	**55.12**	**0.29**	**5.40**	**1.04**	**14.90**	**13.58**	**0.12**	**4.80**	**4.31**	**0.02**	**99.36**
97dst06-14di	53.64	0.00	1.56	1.04	16.22	21.26	0.10	4.27	0.76	0.00	98.86
97dst07-6di	53.69	0.18	1.69	1.04	15.32	22.78	0.13	4.23	0.74	0.00	99.80

Cr-Diopside, Cr_2O_3 wt % Values > 1 (Continued)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
97dst08-2di	53.56	0.18	1.50	1.06	15.88	23.16	0.13	3.47	0.65	0.00	99.58
97dst08-8di	**53.65**	**0.06**	**1.53**	**1.48**	**15.18**	**24.03**	**0.06**	**3.07**	**0.72**	**0.00**	**99.77**
97dst100-23di	**54.25**	**0.10**	**1.69**	**1.06**	**15.56**	**21.82**	**0.08**	**4.15**	**1.07**	**0.00**	**99.78**
97dst100-24di	**53.73**	**0.08**	**2.68**	**1.35**	**15.17**	**21.69**	**0.07**	**3.08**	**1.44**	**0.00**	**99.30**
97dst102-33di	53.41	0.31	1.24	1.10	18.45	17.09	0.18	7.27	0.43	0.00	99.47
97dst102-40di	53.77	0.33	0.72	1.00	17.95	20.14	0.12	5.09	0.42	0.00	99.53
97dst102-41di	**53.98**	**0.07**	**1.05**	**1.40**	**14.26**	**22.62**	**0.12**	**4.68**	**1.51**	**0.00**	**99.69**
97dst103-108di	**54.79**	**0.19**	**0.85**	**2.33**	**15.70**	**20.87**	**0.04**	**2.85**	**1.91**	**0.02**	**99.56**
97dst103-109di	**54.71**	**0.19**	**0.60**	**1.40**	**15.97**	**21.72**	**0.07**	**3.29**	**1.64**	**0.00**	**99.59**
97dst103-110di	**55.00**	**0.17**	**1.97**	**2.64**	**14.77**	**19.98**	**0.02**	**2.54**	**2.76**	**0.00**	**99.86**
97dst103-79di	**54.77**	**0.14**	**0.54**	**1.53**	**16.09**	**21.83**	**0.10**	**2.91**	**1.51**	**0.00**	**99.43**
97dst105-68di	**52.73**	**0.29**	**5.14**	**1.34**	**15.22**	**19.65**	**0.17**	**3.71**	**1.85**	**0.00**	**100.10**
98dst05-dc3	**54.41**	**0.04**	**3.02**	**2.21**	**15.13**	**20.46**	**0.06**	**1.59**	**2.32**	**0.00**	**99.24**
98dst100-dc4	53.70	0.22	1.04	1.35	17.60	20.89	0.12	3.98	0.54	0.00	99.44
98dst105-dc8	**53.07**	**0.27**	**6.64**	**1.42**	**12.92**	**19.18**	**0.12**	**3.02**	**3.04**	**0.00**	**99.67**
98dst105-dc9	**52.41**	**0.16**	**5.60**	**1.53**	**15.70**	**20.35**	**0.09**	**2.55**	**1.39**	**0.01**	**99.77**
98dst300-dc10	**54.41**	**0.32**	**1.99**	**1.54**	**15.57**	**19.34**	**0.09**	**3.43**	**2.22**	**0.02**	**98.94**
98dst300-dc11	**54.58**	**0.24**	**1.18**	**1.41**	**16.02**	**20.77**	**0.10**	**3.23**	**1.75**	**0.02**	**99.30**
98dst300-dc13	53.67	0.09	1.65	1.02	16.24	22.79	0.10	3.79	0.60	0.00	99.95
98dst301-dc14	**53.80**	**0.12**	**1.70**	**1.52**	**15.94**	**22.84**	**0.11**	**2.59**	**0.93**	**0.00**	**99.55**
98dst303-dc17	**53.65**	**0.13**	**1.66**	**1.16**	**15.85**	**22.72**	**0.11**	**3.48**	**0.81**	**0.00**	**99.56**
98dst304-dc18	53.14	0.07	1.82	1.17	15.62	22.72	0.24	3.94	0.58	0.00	99.29
98dst304-dc19	**54.98**	**0.24**	**6.12**	**1.03**	**13.63**	**13.86**	**0.13**	**4.75**	**4.71**	**0.01**	**99.46**
99-DST-33-01	53.88	0.06	1.31	1.00	16.01	23.16	0.18	3.74	0.62	0.00	99.96
01-DST-03-12	53.94	0.31	1.12	1.05	17.74	20.73	0.13	4.96	0.41	0.00	100.39
00-DST-18-02	53.11	0.02	2.32	1.06	15.05	22.65	0.27	4.54	0.75	0.00	99.77
00-DST-400-02	53.54	0.04	1.86	1.07	15.54	22.81	0.16	4.21	0.69	0.00	99.91
00-DST-02-01	**54.19**	**0.10**	**1.47**	**1.07**	**15.40**	**22.26**	**0.12**	**4.27**	**0.96**	**0.00**	**99.85**
01-DST-02-15	52.57	0.44	1.54	1.09	17.19	19.07	0.17	6.76	0.39	0.00	99.22
01-DST-02-20	53.20	0.43	1.48	1.12	17.31	19.36	0.15	6.61	0.43	0.00	100.08
01-DST-03-13	53.55	0.36	1.17	1.14	17.72	20.74	0.13	4.73	0.43	0.00	99.96
01-DST-02-17	52.41	0.44	1.68	1.18	17.04	19.52	0.17	6.52	0.43	0.00	99.38
00-DST-17-02	53.27	0.25	1.38	1.47	18.02	19.05	0.13	5.21	0.61	0.00	99.39
00-DST-108-a-01	**55.31**	**0.20**	**2.68**	**1.75**	**16.08**	**18.75**	**0.10**	**3.11**	**2.32**	**0.03**	**100.32**
00-DST-108-bcde-25	54.73	0.17	0.58	1.85	16.01	22.08	0.07	2.92	1.58	0.01	100.01
95dst02-1cpyx	51.80	0.56	1.76	0.03	16.71	12.32	0.35	14.83	0.26	0.00	98.61
95dst02-7cpyx	51.85	0.59	1.59	0.02	15.92	14.72	0.36	14.54	0.13	0.01	99.72
95dst08-1di	53.05	0.15	2.64	0.92	18.27	18.83	0.22	5.44	0.46	0.00	99.98
95dst120b-2di	54.39	0.00	0.97	0.56	17.07	23.33	0.11	2.56	0.47	0.00	99.44

Cr-Diopside, Cr_2O_3 wt % Values > 1 (Continued)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
97dst08-2di	53.56	0.18	1.50	1.06	15.88	23.16	0.13	3.47	0.65	0.00	99.58
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.72	0.00	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21.82	0.08	4.16	1.07	0.00	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	[illegible]
97dst102-33di	53.41	0.31	1.24	1.10	18.45	17.09	0.18	7.27	0.43	0.00	99.47
97dst102-40di	53.77	0.33	0.72	1.00	17.95	20.14	0.12	5.09	0.42	0.00	99.53
97dst102-41di	53.98	0.07	1.05	1.40	14.26	22.62	0.12	4.68	1.51	0.00	99.69
97dst103-108di	54.79	0.19	0.85	2.33	15.70	20.87	0.04	2.85	1.91	0.02	99.56
97dst103-109di	54.71	0.19	0.60	1.40	15.97	21.72	0.07	3.29	1.64	0.00	99.59
97dst103-110di	55.00	0.17	1.97	2.64	14.77	19.98	0.02	2.54	2.76	0.00	99.86
97dst103-79di	54.77	0.14	0.54	1.53	16.09	21.83	0.10	2.91	1.51	0.00	99.43
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17	3.71	1.85	0.00	[illegible]
98dst05-dc3	54.41	0.04	3.02	2.21	15.13	20.46	0.06	1.59	2.32	0.00	99.24
98dst100-dc4	53.70	0.22	1.04	1.35	17.60	20.89	0.12	3.98	0.54	0.00	99.44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.30	0.01	[illegible]
98dst300-dc10	54.41	0.32	1.99	1.54	15.57	19.34	0.09	3.43	2.22	0.02	98.94
98dst300-dc11	54.58	0.24	1.18	1.41	16.02	20.77	0.10	3.23	1.75	0.02	99.30
98dst300-dc13	53.67	0.09	1.65	1.02	16.24	22.79	0.10	3.79	0.60	0.00	99.95
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	[illegible]
98dst304-dc18	53.14	0.07	1.82	1.17	15.62	22.72	0.24	3.94	0.58	0.00	99.29
98dst304-dc19	54.98	0.24	6.12	1.03	13.63	13.86	0.13	4.75	4.71	0.01	99.46
99-DST-33-01	53.88	0.06	1.31	1.00	16.01	23.16	0.18	3.74	0.62	0.00	99.96
01-DST-03-12	53.94	0.31	1.12	1.05	17.74	20.73	0.13	4.96	0.41	0.00	100.39
00-DST-18-02	53.11	0.02	2.32	1.06	15.05	22.65	0.27	4.54	0.75	0.00	99.77
00-DST-400-02	53.54	0.04	1.86	1.07	15.54	22.81	0.16	4.21	0.69	0.00	99.91
[illegible]	[illegible]	[illegible]	1.47	1.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	[illegible]
01-DST-02-15	52.57	0.44	1.54	1.09	17.19	19.07	0.17	6.76	0.39	0.00	99.22
01-DST-02-20	53.20	0.43	1.48	1.12	17.31	19.36	0.15	6.61	0.43	0.00	100.08
01-DST-03-13	53.55	0.36	1.17	1.14	17.72	20.74	0.13	4.73	0.43	0.00	99.96
01-DST-02-17	52.41	0.44	1.68	1.18	17.04	19.52	0.17	6.52	0.43	0.00	99.38
00-DST-17-02	53.27	0.25	1.38	1.47	18.02	19.05	0.13	5.21	0.61	0.00	99.39
00-DST-108-a-01	55.31	0.20	2.68	1.75	16.08	18.75	0.10	3.11	2.32	0.03	100.32
00-DST-108-bcde-25	54.73	0.17	0.58	1.85	16.01	22.08	0.07	2.92	1.58	0.01	100.01
95dst02-1cpyx	51.80	0.56	1.76	0.03	16.71	12.32	0.35	14.83	0.26	0.00	98.61
95dst02-7cpyx	51.85	0.59	1.59	0.02	15.92	14.72	0.36	14.54	0.13	0.01	99.72
95dst08-1di	53.05	0.15	2.64	0.92	18.27	18.83	0.22	5.44	0.46	0.00	99.98
95dst120b-2di	54.39	0.00	0.97	0.56	17.07	23.33	0.11	2.56	0.47	0.00	99.44

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Cr-Diopside, Cr_2O_3 wt % Values < 1

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst121b-2di	53.75	0.06	1.62	0.73	16.37	23.37	0.10	2.69	0.64	0.00	99.32

Cr-Diopside, Cr_2O_3 wt % Values < 1 (Continued)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst203-17di	54.78	0.14	0.61	0.27	16.19	22.27	0.14	4.18	1.12	0.00	99.71
95dst207b-5di	53.56	0.01	1.38	0.94	16.20	22.31	0.12	4.07	0.73	0.00	99.32
95dst208b-11di	54.40	0.00	0.60	0.38	15.63	24.31	0.14	3.86	0.51	0.00	99.83
95dst208b-12di	54.08	0.07	0.70	0.31	15.74	24.18	0.13	3.64	0.59	0.00	99.42
95dst208b-13di	53.77	0.08	1.57	0.26	15.73	22.89	0.15	4.78	0.60	0.00	99.82
95dst208b-14di	54.43	0.03	2.47	0.31	15.50	21.85	0.07	3.55	1.37	0.00	99.59
95dst208b-15di	54.43	0.05	0.86	0.40	16.49	22.87	0.14	3.56	0.62	0.00	99.41
95dst208b-18di	53.92	0.00	0.93	0.58	15.18	22.75	0.20	4.88	0.85	0.01	99.29
95dst208b-21di	54.11	0.07	0.62	0.81	15.66	23.90	0.10	3.66	0.74	0.00	99.66
95dst208b-22di	54.15	0.03	1.21	0.52	15.58	23.27	0.18	4.18	0.65	0.00	99.77
95dst208b-24di	54.23	0.00	1.37	0.84	16.27	22.52	0.14	3.74	0.77	0.01	99.89
95dst208b-26di	54.40	0.02	0.70	0.55	16.82	23.43	0.21	2.99	0.43	0.00	99.55
95dst208b-27di	54.33	0.01	0.68	0.46	15.58	24.30	0.15	3.85	0.59	0.00	99.96
95dst208b-9di	53.60	0.03	1.74	0.99	15.98	22.93	0.13	3.42	0.73	0.01	99.55
95dst209b-6di	53.31	0.08	1.19	0.97	15.15	22.31	0.12	4.85	0.83	0.00	98.81
95dst209b-7di	53.90	0.07	1.35	0.63	15.97	23.40	0.09	3.46	0.52	0.03	99.42
95dst209b-8di	53.31	0.09	1.65	0.85	15.75	23.31	0.08	3.61	0.40	0.01	99.06
95dst209b-9di	54.02	0.03	1.60	0.68	16.55	23.52	0.08	2.31	0.60	0.00	99.39
95dst25b-2di	54.37	0.03	0.69	0.21	15.24	23.88	0.20	4.96	0.60	0.00	100.19
95dst25b-3di	54.20	0.05	0.67	0.29	15.77	24.09	0.12	3.62	0.60	0.00	99.43
95dst30b-1di	54.20	0.09	1.06	0.75	16.42	23.29	0.04	3.42	0.63	0.00	99.90
95dst30b-2di	54.42	0.00	1.00	0.70	16.58	23.08	0.09	3.14	0.62	0.00	99.64
96dst03-49di	53.57	0.05	1.27	0.68	15.54	22.96	0.15	4.37	0.61	0.00	99.19
96dst03-51di	53.61	0.19	1.58	0.72	15.95	23.40	0.12	3.67	0.55	0.00	99.80
96dst03-52di	54.61	0.05	0.35	0.65	16.49	22.86	0.14	4.05	0.65	0.00	99.85
96dst05-7di	53.77	0.07	1.40	0.55	15.89	22.83	0.13	4.19	0.61	0.01	99.44
96dst05-8di	54.23	0.08	1.48	0.48	15.70	21.89	0.10	4.14	1.21	0.00	99.31
96dst102-11	54.24	0.03	0.81	0.35	15.22	23.77	0.16	4.30	0.79	0.00	99.67
96dst102-12	53.89	0.00	1.51	0.61	16.35	22.95	0.11	3.54	0.48	0.00	99.44
96dst201-17	54.41	0.05	0.00	0.36	15.12	25.03	0.33	4.65	0.25	0.00	100.19
96dst201-18	53.59	0.15	1.15	0.77	17.03	22.58	0.12	3.61	0.35	0.00	99.36
96dst202-11	54.09	0.07	1.05	0.80	15.99	22.71	0.19	4.41	0.53	0.00	99.84
97dst01-20di	54.36	0.06	0.62	0.58	15.31	23.25	0.23	4.88	0.76	0.00	100.05
97dst01-21di	54.51	0.02	0.92	0.43	16.27	23.25	0.19	3.80	0.53	0.00	99.92
97dst02-6di	54.19	0.00	1.08	0.68	16.31	22.25	0.13	4.69	0.55	0.00	99.87
97dst04-32di	54.11	0.03	0.97	0.66	17.11	22.69	0.10	3.15	0.52	0.00	99.35

Cr-Diopside, Cr_2O_3 wt % Values < 1

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst121b-2di	53.75	0.06	1.62	0.73	16.37	23.37	0.10	2.69	0.64	0.00	99.32

Cr-Diopside, Cr_2O_3 wt % Values < 1 (Continued)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst203-17di	54.78	0.14	0.61	0.27	16.19	22.27	0.14	4.18	1.12	0.00	99.71
95dst207b-5di	53.56	0.01	1.38	0.94	16.20	22.31	0.12	4.07	0.73	0.00	99.32
95dst208b-11di	54.40	0.00	0.60	0.38	15.63	24.31	0.14	3.86	0.51	0.00	99.83
95dst208b-12di	54.08	0.07	0.70	0.31	15.74	24.18	0.13	3.64	0.59	0.00	99.42
95dst208b-13di	53.77	0.08	1.57	0.26	15.73	22.89	0.15	4.78	0.60	0.00	99.82
95dst208b-14di	54.43	0.03	2.47	0.31	15.50	21.85	0.07	3.55	1.37	0.00	99.59
95dst208b-15di	54.43	0.05	0.86	0.40	16.49	22.87	0.14	3.56	0.62	0.00	99.41
95dst208b-18di	53.92	0.00	0.93	0.58	15.18	22.75	0.20	4.88	0.85	0.01	99.29
95dst208b-21di	54.11	0.07	0.62	0.81	15.66	23.90	0.10	3.66	0.74	0.00	99.66
95dst208b-22di	54.15	0.03	1.21	0.52	15.58	23.27	0.18	4.18	0.65	0.00	99.77
95dst208b-24di	54.23	0.00	1.37	0.84	16.27	22.52	0.14	3.74	0.77	0.01	99.89
95dst208b-26di	54.40	0.02	0.70	0.55	16.82	23.43	0.21	2.99	0.43	0.00	99.55
95dst208b-27di	54.33	0.01	0.68	0.46	15.58	24.30	0.15	3.85	0.59	0.00	99.96
95dst208b-9di	53.60	0.03	1.74	0.99	15.98	22.93	0.13	3.42	0.73	0.01	99.55
95dst209b-6di	53.31	0.08	1.19	0.97	15.15	22.31	0.12	4.85	0.83	0.00	98.81
95dst209b-7di	53.90	0.07	1.35	0.63	15.97	23.40	0.09	3.46	0.52	0.03	99.42
95dst209b-8di	53.31	0.09	1.65	0.85	15.75	23.31	0.08	3.61	0.40	0.01	99.06
95dst209b-9di	54.02	0.03	1.60	0.68	16.55	23.52	0.08	2.31	0.60	0.00	99.39
95dst25b-2di	54.37	0.03	0.69	0.21	15.24	23.88	0.20	4.96	0.60	0.00	100.19
95dst25b-3di	54.20	0.05	0.67	0.29	15.77	24.09	0.12	3.62	0.60	0.00	99.43
95dst30b-1di	54.20	0.09	1.06	0.75	16.42	23.29	0.04	3.42	0.63	0.00	99.90
95dst30b-2di	54.42	0.00	1.00	0.70	16.58	23.08	0.09	3.14	0.62	0.00	99.64
96dst03-49di	53.57	0.05	1.27	0.68	15.54	22.96	0.15	4.37	0.61	0.00	99.19
96dst03-51di	53.61	0.19	1.58	0.72	15.95	23.40	0.12	3.67	0.55	0.00	99.80
96dst03-52di	54.61	0.05	0.35	0.65	16.49	22.86	0.14	4.05	0.65	0.00	99.85
96dst05-7di	53.77	0.07	1.40	0.55	15.89	22.83	0.13	4.19	0.61	0.01	99.44
96dst05-8di	54.23	0.08	1.48	0.48	15.70	21.89	0.10	4.14	1.21	0.00	99.31
96dst102-11	54.24	0.03	0.81	0.35	15.22	23.77	0.16	4.30	0.79	0.00	99.67
96dst102-12	53.89	0.00	1.51	0.61	16.35	22.95	0.11	3.54	0.48	0.00	99.44
96dst201-17	54.41	0.05	0.00	0.36	15.12	25.03	0.33	4.65	0.25	0.00	100.19
96dst201-18	53.59	0.15	1.15	0.77	17.03	22.58	0.12	3.61	0.35	0.00	99.36
96dst202-11	54.09	0.07	1.05	0.80	15.99	22.71	0.19	4.41	0.53	0.00	99.84
97dst01-20di	54.36	0.06	0.62	0.58	15.31	23.25	0.23	4.88	0.76	0.00	100.05
97dst01-21di	54.51	0.02	0.92	0.43	16.27	23.25	0.19	3.80	0.53	0.00	99.92
97dst02-6di	54.19	0.00	1.08	0.68	16.31	22.25	0.13	4.69	0.55	0.00	99.87
97dst04-32di	54.11	0.03	0.97	0.66	17.11	22.69	0.10	3.15	0.52	0.00	99.35

Cr-Diopside, Cr_2O_3 wt % Values < 1 (Continued)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
97dst05-41di	52.51	0.57	1.64	0.70	17.00	20.10	0.14	6.10	0.43	0.00	99.20
97dst05-42di	53.89	0.07	1.63	0.50	15.80	22.73	0.20	4.12	0.66	0.00	99.60
97dst05-43di	**54.17**	**0.07**	**1.02**	**0.22**	**15.37**	**24.16**	**0.12**	**4.18**	**0.60**	**0.00**	**99.91**
97dst05-44di	54.39	0.06	1.28	0.41	17.62	19.97	0.26	5.38	0.63	0.00	100.00
97dst05-45di	53.53	0.40	0.85	0.75	17.10	20.72	0.14	5.70	0.40	0.00	99.58
97dst05-46di	**55.04**	**0.23**	**3.24**	**0.95**	**16.29**	**17.00**	**0.11**	**4.08**	**2.76**	**0.02**	**99.72**
97dst05-47di	54.57	0.06	0.92	0.53	16.93	22.42	0.14	3.87	0.60	0.00	100.03
97dst05-49di	54.30	0.08	0.91	0.91	16.56	23.15	0.12	3.18	0.56	0.00	99.76
97dst05-50di	53.31	0.11	2.44	0.62	17.32	21.98	0.09	3.70	0.35	0.01	99.90
97dst05-51di	53.63	0.17	1.59	0.94	16.90	22.86	0.07	3.07	0.46	0.00	99.68
97dst05-53di	53.64	0.33	0.81	0.91	17.50	20.63	0.12	4.93	0.45	0.00	99.32
97dst05-54di	53.79	0.08	1.44	0.75	15.93	23.29	0.10	3.18	0.58	0.00	99.15
97dst06-13di	53.61	0.14	1.57	0.70	16.07	22.78	0.14	4.17	0.57	0.00	99.74
97dst06-15di	53.97	0.00	1.52	0.59	15.88	23.06	0.17	3.99	0.63	0.00	99.82
97dst06-16di	54.30	0.03	1.16	0.59	16.07	23.28	0.11	3.49	0.63	0.00	99.66
97dst07-5di	54.39	0.03	1.22	0.51	16.39	22.48	0.14	4.44	0.58	0.00	100.18
97dst07-7di	53.93	0.04	1.55	0.73	16.52	23.62	0.12	2.91	0.44	0.00	99.87
97dst09-15di	54.51	0.04	1.04	0.93	16.70	22.63	0.09	3.21	0.65	0.00	99.80
97dst100-25di	**54.34**	**0.06**	**0.59**	**0.23**	**16.47**	**22.55**	**0.17**	**4.66**	**0.46**	**0.01**	**99.55**
97dst100-26di	53.27	0.12	2.17	0.98	16.01	23.17	0.10	3.31	0.58	0.00	99.69
97dst100-27di	54.37	0.01	1.12	0.57	16.01	23.19	0.10	3.70	0.62	0.00	99.69
97dst101-35di	**54.41**	**0.04**	**0.55**	**0.58**	**15.71**	**23.73**	**0.20**	**4.28**	**0.57**	**0.00**	**100.08**
97dst101-36di	54.10	0.16	1.44	0.86	17.39	22.47	0.05	2.78	0.52	0.01	99.78
97dst101-37di	54.11	0.06	1.29	0.56	16.26	23.38	0.18	3.76	0.53	0.00	100.12
97dst101-38di	53.48	0.07	1.48	0.59	16.16	22.10	0.15	4.76	0.50	0.01	99.29
97dst101-39di	**55.33**	**0.33**	**6.33**	**0.61**	**13.09**	**14.19**	**0.10**	**4.61**	**4.84**	**0.01**	**99.45**
97dst102-30di	54.10	0.00	1.40	0.58	16.91	22.00	0.18	3.97	0.53	0.00	99.67
97dst102-31di	54.05	0.03	1.28	0.80	15.87	22.84	0.29	4.03	0.65	0.00	99.85
97dst102-32di	**54.30**	**0.16**	**0.88**	**0.51**	**16.40**	**23.43**	**0.14**	**3.06**	**0.81**	**0.00**	**99.68**
97dst102-34di	53.03	0.33	1.28	0.59	17.33	19.88	0.17	6.01	0.47	0.00	99.08
97dst102-35di	53.14	0.09	2.24	0.79	15.94	23.17	0.12	3.69	0.47	0.00	99.66
97dst102-36di	54.32	0.08	0.69	0.72	16.26	22.87	0.15	4.28	0.48	0.00	99.84
97dst102-37di	54.01	0.06	1.76	0.53	16.04	22.96	0.15	3.77	0.72	0.00	99.99
97dst102-38di	53.35	0.41	0.94	0.93	17.27	20.36	0.14	5.53	0.44	0.00	99.37
97dst102-39di	54.35	0.06	1.51	0.40	16.81	22.36	0.12	4.01	0.67	0.00	100.29
97dst103-100di	54.67	0.07	1.04	0.35	17.93	20.16	0.11	4.84	0.54	0.00	99.71
97dst103-101di	54.35	0.19	0.68	0.35	18.00	23.12	0.09	3.00	0.22	0.00	100.00
97dst103-102di	54.36	0.12	0.59	0.47	17.72	22.55	0.09	2.96	0.41	0.00	99.28
97dst103-103di	**54.77**	**0.21**	**3.59**	**0.90**	**16.20**	**16.01**	**0.11**	**4.37**	**2.90**	**0.01**	**99.10**

Cr-Diopside, Cr_2O_3 wt % Values < 1 (Continued)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
97dst103-104di	**54.41**	**0.00**	**0.76**	**0.49**	**15.92**	**24.17**	**0.15**	**3.21**	**0.56**	**0.00**	**99.69**
97dst103-105di	53.99	0.16	0.85	0.79	17.54	22.13	0.13	3.51	0.36	0.00	99.47
97dst103-107di	53.96	0.11	1.23	0.76	16.20	22.64	0.14	3.93	0.66	0.01	99.63
97dst103-80di	53.54	0.07	1.63	0.81	15.90	22.95	0.16	4.02	0.53	0.00	99.61
97dst103-81di	**54.44**	**0.05**	**0.72**	**0.30**	**15.90**	**23.77**	**0.13**	**3.56**	**0.59**	**0.00**	**99.45**
97dst103-82di	53.63	0.02	1.48	0.79	15.67	22.95	0.15	3.87	0.68	0.00	99.24
97dst103-83di	53.68	0.14	1.66	0.59	16.30	23.60	0.06	3.25	0.43	0.00	99.70
97dst103-84di	53.16	0.13	2.13	0.94	17.28	22.22	0.08	3.33	0.47	0.00	99.73
97dst103-85di	54.41	0.02	1.21	0.44	17.02	23.65	0.11	2.71	0.38	0.00	99.97
97dst103-86di	53.63	0.08	1.35	0.49	16.00	23.16	0.11	4.13	0.43	0.00	99.39
97dst103-87di	**54.15**	**0.11**	**1.00**	**0.67**	**15.40**	**23.83**	**0.14**	**3.91**	**0.74**	**0.00**	**99.95**
97dst103-88di	**54.66**	**0.05**	**2.67**	**0.41**	**15.03**	**20.73**	**0.09**	**4.53**	**1.72**	**0.00**	**99.89**
97dst103-89di	53.05	0.15	1.67	0.80	15.24	22.33	0.24	5.06	0.64	0.00	99.16
97dst103-90di	54.22	0.02	1.19	0.52	16.27	23.25	0.14	3.71	0.57	0.00	99.90
97dst103-91di	53.29	0.06	1.97	0.45	15.32	22.59	0.18	5.39	0.60	0.00	99.85
97dst103-93di	**52.88**	**0.31**	**5.72**	**0.89**	**14.48**	**20.58**	**0.11**	**2.68**	**2.14**	**0.01**	**99.79**
97dst103-94di	54.25	0.08	0.85	0.39	16.76	23.23	0.16	3.46	0.48	0.00	99.66
97dst103-95di	**54.22**	**0.06**	**1.10**	**0.30**	**15.47**	**23.71**	**0.15**	**4.04**	**0.73**	**0.00**	**99.80**
97dst103-96di	53.66	0.03	1.33	0.48	16.65	22.22	0.13	3.85	0.65	0.00	99.00
97dst103-97di	54.19	0.01	0.99	0.43	17.71	19.80	0.12	6.34	0.39	0.00	99.98
97dst103-98di	54.68	0.01	0.91	0.53	16.66	23.03	0.13	3.59	0.49	0.00	100.03
97dst103-99di	54.44	0.01	0.97	0.55	16.34	23.29	0.12	4.05	0.56	0.00	100.33
97dst104-1di	54.27	0.00	1.19	0.52	16.77	23.50	0.12	3.22	0.33	0.00	99.92
97dst104-2di	54.17	0.07	0.99	0.77	17.54	22.45	0.10	3.37	0.35	0.01	99.82
97dst105-60di	54.03	0.08	1.18	0.75	16.25	23.36	0.11	3.39	0.61	0.01	99.77
97dst105-61di	53.41	0.19	1.78	0.76	15.71	23.37	0.14	3.84	0.49	0.00	99.71
97dst105-62di	53.96	0.07	1.22	0.38	16.40	23.41	0.13	3.97	0.35	0.00	99.90
97dst105-63di	53.29	0.06	1.16	0.46	16.01	20.82	0.28	6.42	0.43	0.00	98.92
97dst105-64di	**53.33**	**0.08**	**1.43**	**0.00**	**16.19**	**25.22**	**0.03**	**3.23**	**0.11**	**0.01**	**99.62**
97dst105-65di	53.69	0.04	1.84	0.80	16.85	21.43	0.16	4.01	0.52	0.01	99.35
97dst105-66di	53.62	0.02	1.72	0.56	16.42	23.58	0.15	3.10	0.37	0.00	99.54
97dst105-67di	53.66	0.13	1.19	0.69	15.63	22.47	0.18	4.72	0.69	0.00	99.37
97dst105-69di	**53.69**	**0.00**	**0.91**	**0.60**	**14.61**	**23.59**	**0.40**	**5.07**	**0.68**	**0.00**	**99.54**
97dst107-1di	53.73	0.08	1.43	0.69	15.50	22.85	0.15	4.00	0.74	0.00	99.17
97dst108-22di	53.99	0.00	1.40	0.82	16.07	23.30	0.14	3.60	0.56	0.00	99.87
97dst108-23di	53.55	0.07	1.95	0.51	16.09	23.55	0.11	3.37	0.45	0.00	99.65
97dst108-24di	53.40	0.02	1.43	0.86	16.05	22.84	0.15	4.53	0.54	0.00	99.83
97dst110-4di	**54.43**	**0.02**	**0.33**	**0.34**	**15.63**	**22.53**	**0.13**	**4.57**	**1.12**	**0.00**	**99.10**
97dst110-5di	54.13	0.04	0.89	0.70	16.47	23.31	0.12	3.04	0.49	0.00	99.18

Cr-Diopside, Cr_2O_3 wt % Values < 1 (Continued)											
Sample	**SiO2**	**TiO2**	**Al2O3**	**Cr2O3**	**MgO**	**CaO**	**MnO**	**FeO**	**Na2O**	**K2O**	**Total**
97dst05-41di	52.51	0.57	1.64	0.70	17.00	20.10	0.14	6.10	0.43	0.00	99.20
97dst05-42di	53.89	0.07	1.63	0.50	15.80	22.73	0.20	4.12	0.66	0.00	99.60
97dst05-43di	54.17	0.07	1.02	0.22	15.37	24.16	0.12	4.18	0.60	0.00	99.91
97dst05-44di	54.39	0.06	1.28	0.41	17.62	19.97	0.26	5.38	0.63	0.00	100.00
97dst05-45di	53.53	0.40	0.85	0.75	17.10	20.72	0.14	5.70	0.40	0.00	99.58
97dst05-46di	55.04	0.23	3.24	0.95	16.29	17.00	0.11	4.08	2.76	0.02	99.72
97dst05-47di	54.57	0.06	0.92	0.53	16.93	22.42	0.14	3.87	0.60	0.00	100.03
97dst05-49di	54.30	0.08	0.91	0.91	16.56	23.15	0.12	3.18	0.56	0.00	99.76
97dst05-50di	53.31	0.11	2.44	0.62	17.32	21.98	0.09	3.70	0.35	0.01	99.90
97dst05-51di	53.63	0.17	1.59	0.94	16.90	22.86	0.07	3.07	0.46	0.00	99.68
97dst05-53di	53.64	0.33	0.81	0.91	17.50	20.63	0.12	4.93	0.45	0.00	99.32
97dst05-54di	53.79	0.08	1.44	0.75	15.93	23.29	0.10	3.18	0.58	0.00	99.15
97dst06-13di	53.61	0.14	1.57	0.70	16.07	22.78	0.14	4.17	0.57	0.00	99.74
97dst06-15di	53.97	0.00	1.52	0.59	15.88	23.06	0.17	3.99	0.63	0.00	99.82
97dst06-16di	54.30	0.03	1.16	0.59	16.07	23.28	0.11	3.49	0.63	0.00	99.66
97dst07-5di	54.39	0.03	1.22	0.51	16.39	22.48	0.14	4.44	0.58	0.00	100.18
97dst07-7di	53.93	0.04	1.55	0.73	16.52	23.62	0.12	2.91	0.44	0.00	99.87
97dst09-15di	54.51	0.04	1.04	0.93	16.70	22.63	0.09	3.21	0.65	0.00	99.80
97dst100-25di	54.34	0.06	0.59	0.23	16.47	22.55	0.17	4.66	0.46	0.01	99.55
97dst100-26di	53.27	0.12	2.17	0.98	16.01	23.17	0.10	3.31	0.58	0.00	99.69
97dst100-27di	54.37	0.01	1.12	0.57	16.01	23.19	0.10	3.70	0.62	0.00	99.69
97dst101-35di	54.41	0.04	0.55	0.58	15.71	23.73	0.20	4.28	0.57	0.00	100.08
97dst101-36di	54.10	0.16	1.44	0.86	17.39	22.47	0.05	2.78	0.52	0.01	99.78
97dst101-37di	54.11	0.06	1.29	0.56	16.26	23.38	0.18	3.76	0.53	0.00	100.12
97dst101-38di	53.48	0.07	1.48	0.59	16.16	22.10	0.15	4.76	0.50	0.01	99.29
97dst101-39di	55.33	0.33	6.33	0.61	13.09	14.19	0.10	4.61	4.84	0.01	99.45
97dst102-30di	54.10	0.00	1.40	0.58	16.91	22.00	0.18	3.97	0.53	0.00	99.67
97dst102-31di	54.05	0.03	1.28	0.80	15.87	22.84	0.29	4.03	0.65	0.00	99.85
97dst102-32di	54.30	0.16	0.88	0.51	16.40	23.43	0.14	3.06	0.81	0.00	99.68
97dst102-34di	53.03	0.33	1.28	0.59	17.33	19.88	0.17	6.01	0.47	0.00	99.08
97dst102-35di	53.14	0.09	2.24	0.79	15.94	23.17	0.12	3.69	0.47	0.00	99.66
97dst102-36di	54.32	0.08	0.69	0.72	16.26	22.87	0.15	4.28	0.48	0.00	99.84
97dst102-37di	54.01	0.06	1.76	0.53	16.04	22.96	0.15	3.77	0.72	0.00	99.99
97dst102-38di	53.35	0.41	0.94	0.93	17.27	20.36	0.14	5.53	0.44	0.00	99.37
97dst102-39di	54.35	0.06	1.51	0.40	16.81	22.36	0.12	4.01	0.67	0.00	100.29
97dst103-100di	54.67	0.07	1.04	0.35	17.93	20.16	0.11	4.84	0.54	0.00	99.71
97dst103-101di	54.35	0.19	0.68	0.35	18.00	23.12	0.09	3.00	0.22	0.00	100.00
97dst103-102di	54.36	0.12	0.59	0.47	17.72	22.55	0.09	2.96	0.41	0.00	99.28
97dst103-103di	54.77	0.21	3.59	0.90	16.20	16.01	0.11	4.37	2.90	0.01	99.10

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Cr-Diopside, Cr_2O_3 wt % Values < 1 (Continued)										
Sample	**SiO2**	**TiO2**	**Al2O3**	**Cr2O3**	**MgO**	**CaO**	**MnO**	**FeO**	**Na2O**	**K2O**	**Total**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23.17	[illegible]	3.21	[illegible]	0.00	[illegible]
97dst103-105di	53.99	0.16	0.85	0.79	17.54	22.13	0.13	3.51	0.36	0.00	99.47
97dst103-107di	53.96	0.11	1.23	0.76	16.20	22.64	0.14	3.93	0.66	0.01	99.63
97dst103-80di	53.54	0.07	1.63	0.81	15.90	22.95	0.16	4.02	0.53	0.00	99.61
97dst103-81di	54.44	0.05	0.72	0.30	15.90	23.77	0.13	3.56	0.59	0.00	99.45
97dst103-82di	53.63	0.02	1.48	0.79	15.67	22.95	0.15	3.87	0.68	0.00	99.24
97dst103-83di	53.68	0.14	1.66	0.59	16.30	23.60	0.06	3.25	0.43	0.00	99.70
97dst103-84di	53.16	0.13	2.13	0.94	17.28	22.22	0.08	3.33	0.47	0.00	99.73
97dst103-85di	54.41	0.02	1.21	0.44	17.02	23.65	0.11	2.71	0.38	0.00	99.97
97dst103-86di	53.63	0.08	1.35	0.49	16.00	23.16	0.11	4.13	0.43	0.00	99.39
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
97dst103-88di	54.66	0.05	2.67	0.41	15.03	20.73	0.09	4.53	1.72	0.00	99.89
97dst103-89di	53.05	0.15	1.67	0.80	15.24	22.33	0.24	5.06	0.64	0.00	99.16
97dst103-90di	54.22	0.02	1.19	0.52	16.27	23.25	0.14	3.71	0.57	0.00	99.90
97dst103-91di	53.29	0.06	1.97	0.45	15.32	22.59	0.18	5.39	0.60	0.00	99.85
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14.43	[illegible]	0.11	[illegible]	1.14	[illegible]	[illegible]
97dst103-94di	54.25	0.08	0.85	0.39	16.76	23.23	0.16	3.46	0.48	0.00	99.66
97dst103-95di	54.22	0.06	1.10	0.30	15.47	23.71	0.15	4.04	0.73	0.00	99.80
97dst103-96di	53.66	0.03	1.33	0.48	16.65	22.22	0.13	3.85	0.65	0.00	99.00
97dst103-97di	54.19	0.01	0.99	0.43	17.71	19.80	0.12	6.34	0.39	0.00	99.98
97dst103-98di	54.68	0.01	0.91	0.53	16.66	23.03	0.13	3.59	0.49	0.00	100.03
97dst103-99di	54.44	0.01	0.97	0.55	16.34	23.29	0.12	4.05	0.56	0.00	100.33
97dst104-1di	54.27	0.00	1.19	0.52	16.77	23.50	0.12	3.22	0.33	0.00	99.92
97dst104-2di	54.17	0.07	0.99	0.77	17.54	22.45	0.10	3.37	0.35	0.01	99.82
97dst105-60di	54.03	0.08	1.18	0.75	16.25	23.36	0.11	3.39	0.61	0.01	99.77
97dst105-61di	53.41	0.19	1.78	0.76	15.71	23.37	0.14	3.84	0.49	0.00	99.71
97dst105-62di	53.96	0.07	1.22	0.38	16.40	23.41	0.13	3.97	0.35	0.00	99.90
97dst105-63di	53.29	0.06	1.16	0.46	16.01	20.82	0.28	6.42	0.43	0.00	98.92
[illegible]	[illegible]	0.09	1.43	0.00	[illegible]	25.22	0.03	3.23	0.11	0.01	99.62
97dst105-65di	53.69	0.04	1.84	0.80	16.85	21.43	0.16	4.01	0.52	0.01	99.35
97dst105-66di	53.62	0.02	1.72	0.56	16.42	23.58	0.15	3.10	0.37	0.00	99.54
97dst105-67di	53.66	0.13	1.19	0.69	15.63	22.47	0.18	4.72	0.69	0.00	99.37
[illegible]	[illegible]	[illegible]	[illegible]	0.60	[illegible]	[illegible]	0.40	3.07	[illegible]	0.00	[illegible]
97dst107-1di	53.73	0.08	1.43	0.69	15.50	22.85	0.15	4.00	0.74	0.00	99.17
97dst108-22di	53.99	0.00	1.40	0.82	16.07	23.30	0.14	3.60	0.56	0.00	99.87
97dst108-23di	53.55	0.07	1.95	0.51	16.09	23.55	0.11	3.37	0.45	0.00	99.65
97dst108-24di	53.40	0.02	1.43	0.86	16.05	22.84	0.15	4.53	0.54	0.00	99.83
97dst110-4di	54.43	0.02	0.33	0.34	15.63	22.53	0.13	4.57	1.12	0.00	99.10
97dst110-5di	54.13	0.04	0.89	0.70	16.47	23.31	0.12	3.04	0.49	0.00	99.18

Cr-Diopside, Cr_2O_3 wt % Values < 1 (Continued)										
Sample	**SiO2**	**TiO2**	**Al2O3**	**Cr2O3**	**MgO**	**CaO**	**MnO**	**FeO**	**Na2O**	**K2O**	**Total**
98dst02-dc1	54.08	0.06	1.23	0.65	16.15	23.21	0.10	3.38	0.54	0.00	99.40
98dst02-dc2	53.95	0.05	1.78	0.73	15.75	22.50	0.09	4.13	0.70	0.00	99.69
98dst100-dc5	53.53	0.17	1.27	0.76	17.06	22.84	0.10	2.76	0.56	0.00	99.06
98dst102 dc6	55.07	0.19	6.06	0.93	14.50	13.91	0.12	4.34	4.39	0.00	99.51
98dst102-dc7	54.12	0.06	1.53	0.81	15.99	23.13	0.14	4.14	0.70	0.00	100.62
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00	[illegible]
98dst301-dc15	54.54	0.00	0.80	0.93	16.95	23.03	0.09	2.53	0.59	0.00	99.46
98dst302-dc16	53.30	0.10	2.14	0.72	15.94	21.28	0.16	4.75	0.76	0.00	99.16
98dst304-dc20	54.01	0.00	1.44	0.78	16.94	22.57	0.10	2.85	0.62	0.00	99.33
01-DST-03-10	53.66	0.16	0.49	0.00	15.13	22.15	0.25	7.80	0.38	0.00	100.02
01-DST-05-08	52.95	0.14	1.19	0.01	14.21	22.78	0.31	7.30	0.58	0.01	99.47
01-DST-05-09	51.79	0.62	2.38	0.02	13.77	21.12	0.35	8.61	0.73	0.01	99.40
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.14	0.01	[illegible]
01-DST-02-07	51.04	0.88	2.31	0.03	15.10	16.78	0.33	12.92	0.28	0.00	99.68
01-DST-02-10	50.94	0.85	2.61	0.03	15.36	16.49	0.32	12.82	0.29	0.00	99.70
01-DST-03-09	52.43	0.35	2.47	0.03	16.81	17.23	0.28	10.48	0.24	0.00	100.31
01-DST-05-01	52.29	0.69	2.33	0.04	13.75	21.40	0.30	8.65	0.62	0.02	100.09
01-DST-05-02	51.83	0.68	2.52	0.04	14.13	20.27	0.29	9.59	0.54	0.00	99.89
01-DST-02-13	52.12	0.78	2.25	0.06	15.91	18.21	0.23	9.88	0.40	0.00	99.84
01-DST-05-03	51.62	0.79	2.89	0.06	13.90	20.91	0.26	8.96	0.58	0.00	99.96
01-DST-05-05	51.22	0.84	3.28	0.07	13.62	20.86	0.26	9.09	0.62	0.02	99.87
01-DST-05-04	51.31	0.80	3.28	0.11	13.86	21.01	0.24	8.75	0.64	0.00	99.99
01-DST-03-06	52.35	0.53	1.62	0.14	16.22	20.33	0.19	7.89	0.45	0.00	99.72
01-DST-04-08	51.49	0.48	3.26	0.19	17.76	14.39	0.32	11.34	0.16	0.01	99.39
00-DST-01-02	54.63	0.05	0.70	0.19	16.04	24.53	0.15	3.81	0.45	0.00	100.54
00-DST-01-01	55.14	0.03	0.80	0.20	15.91	24.36	0.12	3.54	0.52	0.00	100.60
01-DST-03-07	53.72	0.43	1.15	0.20	16.72	20.63	0.16	6.73	0.37	0.00	100.11
00-DST-216-01	54.24	0.01	0.60	0.20	16.39	24.48	0.14	3.31	0.45	0.00	99.82
00-DST-206-10	54.33	0.04	0.41	0.25	15.79	24.39	0.14	3.91	0.57	0.00	99.83
00-DST-100-01	54.20	0.02	0.82	0.27	16.35	24.34	0.10	2.92	0.58	0.00	99.60
00-DST-108-bcde-32	53.65	0.05	1.39	0.28	15.98	23.53	0.14	4.27	0.44	0.00	99.73
00-DST-108-bcde-28	53.67	0.10	1.02	0.35	16.00	23.16	0.18	5.13	0.46	0.01	100.07
01-DST-03-08	53.85	0.41	1.13	0.35	17.04	21.19	0.16	6.33	0.37	0.00	100.84
00-DST-108-bcde-29	53.84	0.06	2.43	0.37	15.78	22.35	0.16	4.78	0.66	0.00	100.43
01-DST-05-06	52.16	0.37	2.10	0.38	14.22	22.54	0.25	6.93	0.63	0.02	99.59
00-DST-400-01	54.44	0.04	1.41	0.40	16.93	20.75	0.15	5.60	0.57	0.00	100.29
00-DST-108-bcde-34	54.79	0.00	1.28	0.44	15.99	22.92	0.25	4.24	0.76	0.00	100.65
01-DST-03-14	52.73	0.54	1.58	0.48	17.20	20.38	0.15	6.55	0.40	0.00	100.00
00-DST-201-02	54.92	0.07	0.99	0.49	16.59	23.69	0.11	3.40	0.46	0.00	100.72

Cr Diopside Cr<1.0

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
99-DST-38-01	54.20	0.07	1.32	0.53	16.56	23.41	0.15	3.57	0.43	0.00	100.24
00-DST-205A-03	54.11	0.01	1.38	0.56	16.17	23.11	0.15	3.78	0.59	0.00	99.86
00-DST-08-02	54.54	0.12	1.38	0.59	16.47	23.23	0.11	3.53	0.54	0.00	100.50
00-DST-207-01	53.70	0.05	1.81	0.61	15.61	22.66	0.17	4.35	0.74	0.00	99.70
00-DST-202-03	53.16	0.05	1.27	0.63	15.01	22.14	0.24	6.09	0.74	0.00	99.33
99-DST-206-02	54.94	0.03	0.52	0.64	17.28	23.66	0.28	2.35	0.41	0.00	100.10
00-DST-07-07	53.99	0.08	1.16	0.65	16.21	23.25	0.16	3.75	0.53	0.00	99.78
99-DST-206-01	54.36	0.06	0.75	0.65	16.64	23.52	0.14	3.29	0.52	0.00	99.93
00-DST-108-bcde-33	54.48	0.01	0.78	0.65	15.82	23.33	0.23	4.58	0.56	0.00	100.44
99-DST-102-02	53.85	0.05	1.08	0.66	15.95	23.11	0.13	4.64	0.62	0.00	100.10
99-DST-201-02	53.96	0.11	1.06	0.67	17.66	22.60	0.10	2.94	0.62	0.00	99.71
00-DST-108-bcde-26	55.40	0.36	6.93	0.70	13.21	13.97	0.10	4.70	5.07	0.01	100.44
99-DST-102-03	52.67	0.06	1.98	0.70	14.46	22.70	0.21	6.51	0.66	0.00	99.95
00-DST-108-bcde-35	54.13	0.02	1.07	0.70	16.54	22.69	0.13	3.98	0.58	0.00	99.84
00-DST-108-bcde-30	54.29	0.02	1.19	0.74	15.78	22.99	0.16	3.83	0.89	0.00	99.88
01-DST-03-15	54.06	0.29	0.91	0.75	18.36	20.20	0.14	5.25	0.36	0.00	100.33
00-DST-18-01	54.24	0.06	1.22	0.77	16.52	23.14	0.08	3.29	0.65	0.01	99.98
00-DST-08-03	53.58	0.14	1.30	0.78	17.85	22.87	0.08	3.24	0.14	0.00	99.98
01-DST-02-19	52.87	0.48	1.28	0.81	16.90	19.68	0.18	6.80	0.37	0.00	99.37
99-DST-38-02	53.80	0.05	1.17	0.87	16.18	23.17	0.18	3.93	0.50	0.00	99.85
00-DST-112-02	54.29	0.37	1.06	0.88	17.25	22.78	0.13	2.87	0.58	0.01	100.20
00-DST-206-09	54.14	0.06	0.96	0.90	14.87	22.89	0.16	4.62	1.11	0.00	99.70
00-DST-205A-02	53.44	0.10	1.04	0.90	16.27	21.28	0.30	5.59	0.68	0.00	99.59
00-DST-202-02	54.25	0.05	1.39	0.97	15.87	22.42	0.15	3.97	0.76	0.00	99.82
01-DST-03-11	54.00	0.32	0.87	0.97	18.27	19.84	0.15	5.14	0.41	0.00	99.95
00-DST-108-bcde-31	54.53	0.07	1.59	0.97	16.33	23.00	0.11	3.16	0.73	0.00	100.49
01-DST-02-16	52.77	0.59	1.82	0.98	16.20	20.08	0.16	7.08	0.38	0.00	100.04
01-DST-02-18	52.75	0.45	1.52	0.99	17.46	18.63	0.16	7.00	0.40	0.00	99.36

Cr-Diopside, Cr_2O_3 wt % Values < 1 (Continued)											
Sample	**SiO2**	**TiO2**	**Al2O3**	**Cr2O3**	**MgO**	**CaO**	**MnO**	**FeO**	**Na2O**	**K2O**	**Total**
98dst02-dc1	54.08	0.06	1.23	0.65	16.15	23.21	0.10	3.38	0.54	0.00	99.40
98dst02-dc2	53.95	0.05	1.78	0.73	15.75	22.50	0.09	4.13	0.70	0.00	99.69
98dst100-dc5	53.53	0.17	1.27	0.76	17.06	22.84	0.10	2.76	0.56	0.00	99.06
98dst102-dc6	**55.07**	**0.19**	**6.06**	**0.93**	**14.50**	**13.91**	**0.12**	**4.34**	**4.39**	**0.00**	**99.51**
98dst102-dc7	54.12	0.06	1.53	0.81	15.99	23.13	0.14	4.14	0.70	0.00	100.62
98dst300-dc12	**53.75**	**0.08**	**1.11**	**0.88**	**15.20**	**23.77**	**0.17**	**4.02**	**0.82**	**0.00**	**99.81**
98dst301-dc15	54.54	0.00	0.80	0.93	16.95	23.03	0.09	2.53	0.59	0.00	99.46
98dst302-dc16	53.30	0.10	2.14	0.72	15.94	21.28	0.16	4.75	0.76	0.00	99.16
98dst304-dc20	54.01	0.00	1.44	0.78	16.94	22.57	0.10	2.85	0.62	0.00	99.33
01-DST-03-10	53.66	0.16	0.49	0.00	15.13	22.15	0.25	7.80	0.38	0.00	100.02
01-DST-05-08	52.95	0.14	1.19	0.01	14.21	22.78	0.31	7.30	0.58	0.01	99.47
01-DST-05-09	51.79	0.62	2.38	0.02	13.77	21.12	0.35	8.61	0.73	0.01	99.40
00-DST-12-01	**52.35**	**0.06**	**1.66**	**0.03**	**12.75**	**24.62**	**0.09**	**8.86**	**0.14**	**0.01**	**100.56**
01-DST-02-07	51.04	0.88	2.31	0.03	15.10	16.78	0.33	12.92	0.28	0.00	99.68
01-DST-02-10	50.94	0.85	2.61	0.03	15.36	16.49	0.32	12.82	0.29	0.00	99.70
01-DST-03-09	52.43	0.35	2.47	0.03	16.81	17.23	0.28	10.48	0.24	0.00	100.31
01-DST-05-01	52.29	0.69	2.33	0.04	13.75	21.40	0.30	8.65	0.62	0.02	100.09
01-DST-05-02	51.83	0.68	2.52	0.04	14.13	20.27	0.29	9.59	0.54	0.00	99.89
01-DST-02-13	52.12	0.78	2.25	0.06	15.91	18.21	0.23	9.88	0.40	0.00	99.84
01-DST-05-03	51.62	0.79	2.89	0.06	13.90	20.91	0.26	8.96	0.58	0.00	99.96
01-DST-05-05	51.22	0.84	3.28	0.07	13.62	20.86	0.26	9.09	0.62	0.02	99.87
01-DST-05-04	51.31	0.80	3.28	0.11	13.86	21.01	0.24	8.75	0.64	0.00	99.99
01-DST-03-06	52.35	0.53	1.62	0.14	16.22	20.33	0.19	7.89	0.45	0.00	99.72
01-DST-04-08	51.49	0.48	3.26	0.19	17.76	14.39	0.32	11.34	0.16	0.01	99.39
00-DST-01-02	**54.63**	**0.05**	**0.70**	**0.19**	**16.04**	**24.53**	**0.15**	**3.81**	**0.45**	**0.00**	**100.54**
00-DST-01-01	**55.14**	**0.03**	**0.80**	**0.20**	**15.91**	**24.36**	**0.12**	**3.54**	**0.52**	**0.00**	**100.60**
01-DST-03-07	53.72	0.43	1.15	0.20	16.72	20.63	0.16	6.73	0.37	0.00	100.11
00-DST-216-01	**54.24**	**0.01**	**0.60**	**0.20**	**16.39**	**24.48**	**0.14**	**3.31**	**0.45**	**0.00**	**99.82**
00-DST-206-10	**54.33**	**0.04**	**0.41**	**0.25**	**15.79**	**24.39**	**0.14**	**3.91**	**0.57**	**0.00**	**99.83**
00-DST-100-01	**54.20**	**0.02**	**0.82**	**0.27**	**16.35**	**24.34**	**0.10**	**2.92**	**0.58**	**0.00**	**99.60**
00-DST-108-bcde-32	53.65	0.05	1.39	0.28	15.98	23.53	0.14	4.27	0.44	0.00	99.73
00-DST-108-bcde-28	53.67	0.10	1.02	0.35	16.00	23.16	0.18	5.13	0.46	0.01	100.07
01-DST-03-08	53.85	0.41	1.13	0.35	17.04	21.19	0.16	6.33	0.37	0.00	100.84
00-DST-108-bcde-29	53.84	0.06	2.43	0.37	15.78	22.35	0.16	4.78	0.66	0.00	100.43
01-DST-05-06	52.16	0.37	2.10	0.38	14.22	22.54	0.25	6.93	0.63	0.02	99.59
00-DST-400-01	54.44	0.04	1.41	0.40	16.93	20.75	0.15	5.60	0.57	0.00	100.29
00-DST-108-bcde-34	54.79	0.00	1.28	0.44	15.99	22.92	0.25	4.24	0.76	0.00	100.65
01-DST-03-14	52.73	0.54	1.58	0.48	17.20	20.38	0.15	6.55	0.40	0.00	100.00
00-DST-201-02	54.92	0.07	0.99	0.49	16.59	23.69	0.11	3.40	0.46	0.00	100.72

Cr Diopside Cr<1.0											
Sample	**SiO2**	**TiO2**	**Al2O3**	**Cr2O3**	**MgO**	**CaO**	**MnO**	**FeO**	**Na2O**	**K2O**	**Total**
99-DST-38-01	54.20	0.07	1.32	0.53	16.56	23.41	0.15	3.57	0.43	0.00	100.24
00-DST-205A-03	54.11	0.01	1.38	0.56	16.17	23.11	0.15	3.78	0.59	0.00	99.86
00-DST-08-02	54.54	0.12	1.38	0.59	16.47	23.23	0.11	3.53	0.54	0.00	100.50
00-DST-207-01	53.70	0.05	1.81	0.61	15.61	22.66	0.17	4.35	0.74	0.00	99.70
00-DST-202-03	53.16	0.05	1.27	0.63	15.01	22.14	0.24	6.09	0.74	0.00	99.33
99-DST-206-02	54.94	0.03	0.52	0.64	17.28	23.66	0.28	2.35	0.41	0.00	100.10
00-DST-07-07	53.99	0.08	1.16	0.65	16.21	23.25	0.16	3.75	0.53	0.00	99.78
99-DST-206-01	54.36	0.06	0.75	0.65	16.64	23.52	0.14	3.29	0.52	0.00	99.93
00-DST-108-bcde-33	54.48	0.01	0.78	0.65	15.82	23.33	0.23	4.58	0.56	0.00	100.44
99-DST-102-02	53.85	0.05	1.08	0.66	15.95	23.11	0.13	4.64	0.62	0.00	100.10
99-DST-201-02	53.96	0.11	1.06	0.67	17.66	22.60	0.10	2.94	0.62	0.00	99.71
00-DST-108-bcde-26	55.40	0.36	6.93	0.70	13.21	13.97	0.10	4.70	5.07	0.01	100.44
99-DST-102-03	52.67	0.06	1.98	0.70	14.46	22.70	0.21	6.51	0.66	0.00	99.95
00-DST-108-bcde-35	54.13	0.02	1.07	0.70	16.54	22.69	0.13	3.98	0.58	0.00	99.84
00-DST-108-bcde-30	54.29	0.02	1.19	0.74	15.78	22.99	0.16	3.83	0.89	0.00	99.88
01-DST-03-15	54.06	0.29	0.91	0.75	18.36	20.20	0.14	5.25	0.36	0.00	100.33
00-DST-18-01	54.24	0.06	1.22	0.77	16.52	23.14	0.08	3.29	0.65	0.01	99.98
00-DST-08-03	53.58	0.14	1.30	0.78	17.85	22.87	0.08	3.24	0.14	0.00	99.98
01-DST-02-19	52.87	0.48	1.28	0.81	16.90	19.68	0.18	6.80	0.37	0.00	99.37
99-DST-38-02	53.80	0.05	1.17	0.87	16.18	23.17	0.18	3.93	0.50	0.00	99.85
00-DST-112-02	54.29	0.37	1.06	0.88	17.25	22.78	0.13	2.87	0.58	0.01	100.20
00-DST-206-09	**54.14**	**0.06**	**0.96**	**0.90**	**14.87**	**22.89**	**0.16**	**4.62**	**1.11**	**0.00**	**99.70**
00-DST-205A-02	53.44	0.10	1.04	0.90	16.27	21.28	0.30	5.59	0.68	0.00	99.59
00-DST-202-02	54.25	0.05	1.39	0.97	15.87	22.42	0.15	3.97	0.76	0.00	99.82
01-DST-03-11	54.00	0.32	0.87	0.97	18.27	19.84	0.15	5.14	0.41	0.00	99.95
00-DST-108-bcde-31	54.53	0.07	1.59	0.97	16.33	23.00	0.11	3.16	0.73	0.00	100.49
01-DST-02-16	52.77	0.59	1.82	0.98	16.20	20.08	0.16	7.08	0.38	0.00	100.04
01-DST-02-18	52.75	0.45	1.52	0.99	17.46	18.63	0.16	7.00	0.40	0.00	99.36

olivine

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	CoO	NiO	Total		Ni ppm
97-DST-103-111-ol	40.88	0.01	-	0.10	49.95	0.07	0.10	8.06	-	0.40	99.56		
00-DST-108-bcde-36	40.95	0.02	0.00	0.02	50.65	0.01	0.12	8.09	0.01	0.36	100.24		2805
00-DST-108-bcde-38	39.82	0.01	0.00	0.00	45.92	0.01	0.19	14.32	0.01	0.05	100.31		361
00-DST-108-bcde-39	40.33	0.04	0.02	0.02	48.01	0.04	0.13	11.33	0.02	0.38	100.32		2994
00-DST-108-bcde-40	41.27	0.00	0.00	0.00	49.72	0.01	0.17	9.11	0.02	0.34	100.65		2703
00-DST-108-bcde-41	40.56	0.03	0.01	0.02	50.83	0.01	0.12	8.10	0.02	0.37	100.04		2868
00-DST-108-bcde-42	39.89	0.00	0.00	0.00	46.16	0.00	0.19	14.38	0.01	0.04	100.68		306
00-DST-108-bcde-43	39.42	0.00	0.00	0.01	46.15	0.00	0.18	14.24	0.02	0.05	100.07		377
00-DST-108-bcde-44	40.61	0.02	0.02	0.02	49.16	0.05	0.11	9.64	0.02	0.38	100.03		3018
00-DST-108-bcde-45	39.64	0.00	0.00	0.01	45.99	0.01	0.18	14.06	0.02	0.03	99.95		267
00-DST-200-02	41.32	0.03	0.01	0.03	49.56	0.02	0.13	9.53	0.03	0.31	100.96		2420
00-DST-206-11	40.26	0.05	0.03	0.04	46.92	0.05	0.16	12.51	0.02	0.35	100.37		2735

CR-PYROPE GARNETS

Cr-Pyrope Garnet, "G10"

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst208b-1gp	41.37	0.18	19.14	5.91	21.05	3.62	0.41	7.43	0.06	0.00	99.16
97dst05-28gp	41.48	0.38	18.82	5.78	20.31	4.46	0.40	7.73	0.08	0.00	99.43
97dst102-22gp	41.21	0.01	16.99	8.85	19.54	5.02	0.48	7.67	0.02	0.01	99.79
97dst05-30gp	41.25	0.41	17.07	8.12	19.61	5.45	0.37	7.22	0.06	0.00	99.55
97dst103-64gp	42.02	0.18	21.32	3.07	21.26	4.16	0.38	7.67	0.05	0.00	100.10
97dst105-37gp	41.86	0.29	19.68	4.78	20.66	4.61	0.40	7.83	0.06	0.00	100.18
99-DST-44-01	41.48	0.31	18.18	6.90	20.02	5.10	0.41	7.61	0.08	0.00	100.09
00-DST-108-bcde-15	41.73	0.43	20.58	2.99	20.51	4.19	0.36	8.69	0.08	0.00	99.57
00-DST-108-bcde-02	42.04	0.08	20.43	4.84	22.21	3.45	0.37	6.85	0.05	0.00	100.33
00-DST-108-bcde-19	41.50	0.02	20.22	4.95	20.32	4.63	0.57	8.12	0.03	0.00	100.36

Cr-Pyrope Garnet, "G9"

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst17-1prp	41.39	0.07	18.36	6.45	19.03	6.09	0.42	7.89	0.01	0.00	99.69
95dst25-2prp	41.76	0.01	21.26	3.33	19.32	5.30	0.65	8.42	0.02	0.01	100.07
95dst25-3prp	42.02	0.01	21.29	3.37	19.70	5.02	0.54	8.43	0.02	0.00	100.41
95dst30-26prp	41.85	0.13	20.72	3.69	20.28	5.09	0.41	8.16	0.03	0.01	100.36
95dst30-27prp	42.12	0.35	20.36	3.93	21.14	4.79	0.35	7.14	0.05	0.00	100.24
95dst120-6prp	41.76	0.26	19.58	4.93	20.10	5.04	0.39	7.74	0.05	0.00	99.85
95dst121-3prp	40.69	0.03	16.50	8.96	16.52	8.23	0.46	8.32	0.01	0.00	99.72
95dst122-2prp	41.49	0.04	20.06	4.74	19.60	5.20	0.46	8.13	0.01	0.01	99.74
95dst209-5prp	41.98	0.17	20.79	3.28	20.33	4.96	0.35	7.82	0.03	0.01	99.70
95dst209-6prp	40.75	0.00	17.67	7.62	17.11	7.15	0.56	8.41	0.00	0.00	99.27
95dst209-7prp	41.67	0.04	20.21	4.29	20.08	4.81	0.48	8.10	0.04	0.00	99.71
96dst01-20prp	41.82	0.20	20.52	3.84	20.36	4.83	0.38	7.64	0.03	0.00	99.63

Cr-Pyrope Garnet, "G9" (Continued)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
96dst05-6prp	41.31	0.18	18.97	5.80	19.24	5.92	0.42	7.63	0.03	0.00	99.50
96dst102-10prp	41.86	0.01	20.41	4.51	20.42	4.67	0.48	7.65	0.03	0.01	100.06
96dst201-16prp	41.66	0.24	18.96	5.72	19.97	5.44	0.33	7.46	0.05	0.00	99.84
97dst02-3go	42.36	0.48	20.76	3.08	21.60	4.45	0.25	6.68	0.04	0.00	99.70
97dst05-29gp	41.88	0.15	20.01	4.27	20.13	5.28	0.40	7.66	0.03	0.00	99.81
97dst05-31gp	41.85	0.30	21.02	3.02	20.84	4.56	0.37	7.76	0.06	0.00	99.77
97dst100-7gp	41.98	0.52	19.98	3.50	20.68	5.06	0.33	7.41	0.05	0.00	99.50
97dst100-8gp	41.78	0.23	19.95	4.65	20.58	4.82	0.41	7.27	0.05	0.01	99.76
97dst100-9gp	41.91	0.31	20.34	3.87	20.18	4.82	0.36	8.02	0.03	0.00	99.84
97dst102-23gp	42.08	0.16	19.82	4.57	21.54	4.87	0.28	6.14	0.03	0.01	99.49
97dst103-58gp	41.48	0.04	21.01	3.32	17.72	5.90	0.55	10.22	0.01	0.00	100.25
97dst103-59gp	41.32	0.26	19.14	5.68	20.08	5.09	0.41	7.22	0.06	0.01	99.28
97dst103-60gp	41.25	0.27	17.35	7.53	19.22	5.65	0.41	7.98	0.05	0.00	99.73
97dst103-61gp	41.22	0.29	17.12	7.92	19.16	5.92	0.42	7.67	0.06	0.01	99.79
97dst103-62gp	41.36	0.24	16.72	8.28	19.62	6.02	0.31	6.68	0.02	0.00	99.25
97dst103-63gp	41.86	0.03	21.06	3.63	20.29	4.51	0.52	8.21	0.03	0.00	100.13
97dst103-66gp	41.16	0.05	21.52	2.26	17.30	5.29	0.48	11.71	0.01	0.00	99.78
97dst103-68gp	40.70	0.48	15.37	9.71	17.98	6.67	0.33	8.19	0.07	0.00	99.50
97dst103-73gp	41.75	0.01	20.95	3.62	19.64	5.13	0.55	8.05	0.02	0.01	99.72
97dst103-74gp	41.67	0.45	20.16	3.32	20.31	4.39	0.37	8.64	0.05	0.00	99.37
97dst103-75gp	42.00	0.68	20.10	2.94	20.88	4.86	0.28	7.66	0.06	0.00	99.46
97dst103-76gp	41.59	0.37	19.06	4.99	19.16	5.16	0.45	8.84	0.04	0.00	99.65
97dst105-36gp	41.61	0.29	18.74	5.88	19.79	5.58	0.36	7.61	0.06	0.00	99.92
97dst105-39gp	40.62	0.06	17.99	7.24	17.14	6.91	0.60	8.80	0.04	0.00	99.40
97dst105-40gp	41.25	1.00	19.71	2.58	18.86	5.46	0.42	10.16	0.13	0.00	99.59
97dst105-43gp	41.74	0.25	19.88	4.42	20.53	4.86	0.36	7.31	0.04	0.00	99.39
97dst105-44gp	41.67	0.13	20.41	4.31	19.92	4.68	0.50	8.33	0.03	0.00	99.97
97dst105-45gp	41.41	0.37	19.02	5.55	19.29	5.37	0.42	8.94	0.06	0.00	100.43
97dst105-46gp	41.34	0.09	19.11	6.05	19.59	5.93	0.37	7.28	0.01	0.00	99.79
97dst105-47gp	41.12	0.39	15.94	9.38	19.14	6.89	0.33	6.49	0.02	0.00	99.69
97dst108-20gp	41.44	0.69	18.89	4.60	20.42	5.46	0.28	7.33	0.04	0.00	99.15
95dst25b-1gp	41.49	0.22	18.88	5.74	20.13	5.21	0.42	7.36	0.05	0.00	99.50
95dst207b-1gp	41.75	0.05	20.31	4.24	20.52	4.59	0.51	7.46	0.06	0.00	99.49
95dst207b-2gp	41.58	0.22	19.14	5.16	19.82	4.91	0.44	7.74	0.06	0.00	99.07
95dst207b-3gp	41.67	0.09	20.46	4.27	20.23	5.19	0.41	7.50	0.03	0.00	99.85
95dst208b-2gp	41.57	0.27	20.15	3.88	20.07	4.95	0.47	8.16	0.04	0.01	99.57
95dst208b-3gp	41.27	0.34	19.09	5.47	19.70	5.30	0.42	7.83	0.04	0.00	99.45
95dst208b-4gp	41.56	0.02	21.12	3.04	18.99	5.52	0.52	8.59	0.01	0.00	99.38
95dst208b-5gp	41.91	0.24	19.90	3.70	21.30	4.90	0.23	6.93	0.01	0.01	99.14

Cr-Pyrope Garnet, "G9" (Continued)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst208b-6gp	41.12	0.27	18.41	5.93	19.44	5.52	0.42	7.60	0.05	0.01	98.78
95dst208b-7gp	41.36	0.12	18.71	6.00	19.82	5.34	0.41	7.88	0.02	0.00	99.66
95dst208b-8gp	41.98	0.16	20.54	3.87	20.54	4.49	0.38	7.68	0.04	0.00	99.68
95dst209b-1gp	41.47	0.18	20.60	3.63	19.74	5.00	0.46	7.97	0.04	0.01	99.08
95dst209b-2gp	41.66	0.01	19.20	5.69	20.24	5.59	0.32	6.71	0.02	0.00	99.43
95dst209b-3gp	41.70	0.09	21.38	2.67	19.11	4.98	0.50	9.42	0.03	0.00	99.88
95dst209b-5gp	42.02	0.62	19.95	2.99	20.41	5.32	0.28	8.22	0.04	0.01	99.84
98dst100-gp1	41.42	0.17	19.71	4.93	20.49	5.12	0.36	7.39	0.04	0.01	99.65
98dst100-gp2	41.81	0.01	21.32	2.91	19.21	5.68	0.58	8.44	0.01	0.01	99.99
98dst102-gp3	41.48	0.39	18.76	5.85	20.40	5.09	0.34	7.09	0.07	0.00	99.45
98dst300-gp4	42.21	0.07	21.01	3.23	20.57	4.70	0.32	7.94	0.04	0.00	100.10
98dst301-gp5	41.39	0.18	18.30	6.69	19.76	5.62	0.40	7.53	0.03	0.00	99.90
98dst302-gp6	41.80	0.88	19.34	4.49	20.88	5.27	0.29	6.86	0.08	0.01	99.89

Peridotite Garnets (G9)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
99-DST-39-01	41.52	0.16	18.90	6.08	19.44	5.88	0.46	7.83	0.04	0.00	100.30
99-DST-48-02	41.60	0.02	21.03	3.79	20.51	4.68	0.52	7.85	0.01	0.00	100.02
99-DST-48-03	41.41	0.19	19.26	5.74	20.44	5.18	0.40	7.00	0.05	0.00	99.66
99-DST-48-04	40.53	0.56	17.03	7.75	18.67	6.38	0.46	8.35	0.05	0.00	99.78
99-DST-48-05	41.60	0.09	19.87	4.91	19.66	5.22	0.50	7.94	0.02	0.01	99.81
99-DST-124-01	41.02	0.08	16.98	8.50	18.82	6.24	0.47	7.37	0.03	0.00	99.51
99-DST-201-01	41.24	0.19	17.46	8.23	19.72	5.98	0.44	7.12	0.04	0.01	100.40
00-DST-06-01	41.53	0.26	19.74	4.89	20.61	4.89	0.40	7.49	0.05	0.01	99.87
00-DST-07-01	41.68	0.38	18.50	6.20	20.11	5.40	0.37	7.82	0.05	0.00	100.49
00-DST-17-01	40.97	0.04	19.50	5.50	19.40	5.91	0.44	7.92	0.01	0.00	99.69
00-DST-108-bcde-01	41.46	0.24	18.97	5.87	20.13	5.23	0.43	7.69	0.05	0.00	100.06
00-DST-108-bcde-03	41.33	0.03	17.59	7.80	19.07	6.67	0.38	7.21	0.00	0.00	100.07
00-DST-108-bcde-04	41.34	0.13	19.12	6.32	20.39	5.37	0.40	7.23	0.02	0.01	100.34
00-DST-108-bcde-05	41.12	0.05	20.48	4.58	19.57	5.28	0.53	8.21	0.02	0.00	99.85
00-DST-108-bcde-06	41.75	0.01	21.14	3.55	20.29	4.78	0.51	7.75	0.01	0.00	99.78
00-DST-108-bcde-07	41.50	0.04	17.92	6.92	20.26	5.98	0.36	7.01	0.01	0.00	99.99
00-DST-108-bcde-08	41.50	0.16	20.76	3.90	20.73	5.03	0.38	7.68	0.05	0.00	100.19
00-DST-108-bcde-09	40.79	0.07	16.83	8.65	18.58	6.70	0.47	7.88	0.02	0.00	99.99
00-DST-108-bcde-10	41.48	0.00	21.59	3.11	20.67	4.57	0.50	7.62	0.01	0.00	99.55
00-DST-108-bcde-11	41.75	0.43	18.61	5.82	19.67	5.36	0.52	8.54	0.07	0.00	100.78
00-DST-108-bcde-12	41.62	0.26	20.36	4.26	20.41	4.81	0.39	8.02	0.06	0.00	100.19
00-DST-108-bcde-13	41.36	0.39	20.26	3.36	20.05	5.06	0.41	8.53	0.06	0.00	99.47
00-DST-108-bcde-16	41.54	0.95	19.23	3.24	20.05	5.45	0.35	9.08	0.05	0.00	99.95

Peridotite Garnets (G9)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
00-DST-108-bcde-17	41.81	0.48	20.41	3.27	20.43	4.47	0.39	8.90	0.06	0.00	100.22
00-DST-108-bcde-18	41.62	0.20	19.52	5.34	19.85	5.29	0.43	8.06	0.02	0.00	100.33
00-DST-108-bcde-20	41.49	0.39	20.40	3.93	20.77	4.52	0.40	7.72	0.06	0.00	99.67
00-DST-206-01	41.31	0.38	20.68	3.47	20.15	5.05	0.45	8.75	0.05	0.00	100.29
00-DST-206-02	41.41	0.04	20.15	4.45	19.45	5.63	0.44	8.07	0.00	0.00	99.65

Cr-poor Pyrope Garnet

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst209b-4gp	42.05	0.14	22.11	1.89	20.16	4.29	0.44	8.95	0.04	0.00	100.07
97dst02-4go	42.40	0.45	22.71	0.86	21.71	3.87	0.33	7.80	0.08	0.00	100.21
97dst05-34go	41.82	0.56	21.21	1.90	19.95	4.23	0.46	9.27	0.15	0.01	99.54
97dst103-67gp	42.11	0.48	21.47	2.04	20.88	4.45	0.35	7.95	0.07	0.01	99.81
97dst103-72gp	41.97	0.30	22.08	0.85	20.24	3.96	0.38	9.82	0.10	0.01	99.73
97dst100-12go	41.90	0.43	21.42	1.38	19.71	4.69	0.39	10.16	0.05	0.01	100.13
98dst100-go1	41.96	0.35	21.48	1.68	20.37	3.95	0.40	9.55	0.09	0.01	99.86

Garnet - Almandine-Pyrope (possibly eclogitic)

▨ Group II eclogite

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
97dst100-14go(d)	39.01	0.22	21.71	0.06	9.20	6.30	0.63	21.99	0.01	0.00	99.13
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
97dst101-22go	39.33	0.17	21.67	0.05	8.74	8.10	0.46	21.83	0.00	0.00	100.34
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Possible Eclogite Garnet

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Garnet - Uvarovite

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
96dst01-16grs	38.49	0.80	15.23	7.67	0.00	34.06	1.24	2.54	0.00	0.01	100.04

+6

Peridotite Garnets (G9)

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
00-DST-108-bcde-17	41.81	0.48	20.41	3.27	20.43	4.47	0.39	8.90	0.06	0.00	100.22
00-DST-108-bcde-18	41.62	0.20	19.52	5.34	19.85	5.29	0.43	8.06	0.02	0.00	100.33
00-DST-108-bcde-20	41.49	0.39	20.40	3.93	20.77	4.52	0.40	7.72	0.06	0.00	99.67
00-DST-206-01	41.31	0.38	20.68	3.47	20.15	5.05	0.45	8.75	0.05	0.00	100.29
00-DST-206-02	41.41	0.04	20.15	4.45	19.45	5.63	0.44	8.07	0.00	0.00	99.65

Cr-poor Pyrope Garnet

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst209b-4gp	42.05	0.14	22.11	1.89	20.16	4.29	0.44	8.95	0.04	0.00	100.07
97dst02-4go	42.40	0.45	22.71	0.86	21.71	3.87	0.33	7.80	0.08	0.00	100.21
97dst05-34go	41.82	0.56	21.21	1.90	19.95	4.23	0.46	9.27	0.15	0.01	99.54
97dst103-67gp	42.11	0.48	21.47	2.04	20.88	4.45	0.35	7.95	0.07	0.01	99.81
97dst103-72gp	41.97	0.30	22.08	0.85	20.24	3.96	0.38	9.82	0.10	0.01	99.73
97dst100-12go	41.90	0.43	21.42	1.38	19.71	4.69	0.39	10.16	0.05	0.01	100.13
98dst100-go1	41.96	0.35	21.48	1.68	20.37	3.95	0.40	9.55	0.09	0.01	99.86

Garnet - Almandine-Pyrope (possibly eclogitic)

☐ Group II eclogite

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
97dst100-14go(d)	39.01	0.22	21.71	0.06	9.20	6.30	0.63	21.99	0.01	0.00	99.13
97dst101-20go	**39.91**	**0.04**	**22.44**	**0.01**	**11.31**	**6.11**	**0.48**	**19.88**	**0.01**	**0.01**	**100.21**
97dst101-21go	**40.23**	**0.13**	**22.29**	**0.03**	**11.56**	**7.66**	**0.37**	**18.32**	**0.00**	**0.01**	**100.60**
97dst101-22go	39.33	0.17	21.67	0.05	8.74	8.10	0.46	21.83	0.00	0.00	100.34
97dst101-33alm	**39.17**	**0.19**	**21.78**	**0.00**	**7.83**	**9.38**	**0.34**	**21.36**	**0.02**	**0.00**	**100.06**
97dst102-26go	**39.75**	**0.14**	**22.03**	**0.03**	**9.82**	**9.19**	**0.41**	**18.71**	**0.00**	**0.00**	**100.09**
97dst102-27go	**40.41**	**0.05**	**22.37**	**0.05**	**13.25**	**5.90**	**0.56**	**17.18**	**0.01**	**0.00**	**99.78**
97dst102-29go	**40.14**	**0.07**	**22.37**	**0.05**	**12.33**	**6.82**	**0.41**	**17.58**	**0.00**	**0.01**	**99.78**
97dst103-69gp	**40.28**	**0.07**	**22.16**	**0.24**	**12.35**	**8.11**	**0.44**	**16.56**	**0.00**	**0.00**	**100.20**
97dst103-71gp	**40.40**	**0.15**	**22.48**	**0.07**	**13.32**	**7.42**	**0.39**	**15.90**	**0.00**	**0.00**	**100.15**
97dst105-41gp	**39.25**	**0.11**	**21.84**	**0.02**	**9.25**	**7.65**	**0.51**	**21.37**	**0.00**	**0.00**	**100.01**
97dst105-48go	**40.14**	**0.07**	**22.46**	**0.02**	**12.57**	**5.70**	**0.31**	**18.91**	**0.01**	**0.00**	**100.20**
97dst105-50go	**40.54**	**0.11**	**22.29**	**0.10**	**12.47**	**8.04**	**0.39**	**15.79**	**0.01**	**0.02**	**99.76**
97dst110-3go	**39.76**	**0.14**	**22.08**	**0.07**	**11.14**	**7.61**	**0.39**	**18.63**	**0.01**	**0.01**	**99.83**

Possible Eclogite Garnet

99-DST-48-01	41.03	0.03	23.34	0.00	15.69	8.15	0.16	11.74	0.00	0.00	100.13

Garnet - Uvarovite

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
96dst01-16grs	38.49	0.80	15.23	7.67	0.00	34.06	1.24	2.54	0.00	0.01	100.04

Crustal Garnet - Grossular

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
96dst100-49grs	38.88	0.06	29.26	0.00	0.09	23.68	0.35	5.11	0.01	0.01	97.43
97dst102-18alm	39.39	0.23	20.39	0.01	0.12	32.67	0.69	6.35	0.00	0.00	99.86
98dst303-gr1	40.39	0.00	22.33	0.00	0.09	36.22	0.63	1.24	0.01	0.01	100.93

Crustal Garnet - Spessertine

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst13-6spess	36.68	0.11	20.76	0.00	1.24	2.45	20.60	18.72	0.00	0.00	100.56
97dst100-17alm	37.09	0.17	20.64	0.00	0.31	8.57	18.31	15.06	0.00	0.00	100.14
98dst04-ss1	36.18	0.09	19.30	0.00	1.41	1.53	28.44	12.35	0.01	0.00	99.30
98dst04-ss2	35.95	0.15	19.29	0.00	0.94	1.37	27.83	13.32	0.03	0.00	98.88

Crustal Garnet - Almandine

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
95dst02-11spess	37.06	0.14	20.66	0.01	1.34	4.01	12.53	24.62	0.00	0.00	100.37
95dst02-12spess	37.31	0.20	20.56	0.02	0.90	7.06	10.67	24.10	0.00	0.00	100.81
95dst02-13spess	36.72	0.13	20.36	0.01	1.11	2.47	7.00	32.67	0.00	0.00	100.46
95dst13-1spess	36.74	0.09	20.55	0.03	1.95	1.68	8.78	30.42	0.01	0.00	100.26
95dst13-2spess	37.03	0.22	20.66	0.04	1.72	5.86	10.60	23.95	0.00	0.00	100.08
95dst13-3spess	36.99	0.15	20.43	0.33	2.48	2.86	12.80	24.08	0.00	0.00	100.12
95dst13-4spess	36.43	0.20	20.34	0.07	2.27	1.65	7.87	31.00	0.01	0.00	99.84
95dst13-5spess	37.50	0.16	20.62	0.05	3.47	2.46	1.78	34.32	0.01	0.00	100.38
95dst13-7spess	36.84	0.08	20.63	0.02	2.00	1.64	7.08	32.21	0.01	0.00	100.50
95dst13-8spess	36.93	0.08	20.52	0.00	2.41	2.28	6.65	31.61	0.01	0.00	100.50
95dst13-9spess	37.63	0.06	21.16	0.03	4.12	2.50	1.79	33.48	0.01	0.00	100.78
95dst13-10spess	37.42	0.03	20.92	0.03	3.94	2.26	1.90	34.12	0.01	0.01	100.65
95dst13-11alm	36.87	0.10	20.51	0.04	2.43	2.60	4.44	32.75	0.01	0.01	99.76
95dst13-12alm	37.12	0.06	20.96	0.00	3.16	1.98	1.65	35.36	0.01	0.00	100.29
95dst13-13alm	37.38	0.14	20.86	0.04	3.84	2.06	1.81	34.33	0.00	0.00	100.45
95dst13-14alm	36.78	0.08	20.63	0.01	2.43	2.50	4.66	32.96	0.01	0.00	100.07
95dst13-15alm	36.52	0.27	20.51	0.03	1.61	2.96	11.96	26.37	0.00	0.00	100.23
95dst13-16alm	37.03	0.07	20.70	0.01	2.66	2.64	4.98	32.49	0.00	0.00	100.58
95dst13-17alm	37.03	0.04	20.63	0.01	3.65	1.48	2.25	34.91	0.00	0.01	100.03
95dst13-18alm	37.16	0.10	20.93	0.02	3.45	2.22	1.85	35.33	0.01	0.01	101.08
95dst13-19alm	36.92	0.09	20.61	0.05	2.62	2.01	3.49	34.59	0.03	0.00	100.41
95dst13-20alm	37.27	0.10	20.78	0.00	3.22	2.47	1.84	35.27	0.02	0.00	100.96
95dst13-21alm	37.29	0.08	20.76	0.04	3.16	1.61	2.80	34.60	0.00	0.00	100.34
95dst13-22alm	36.94	0.08	20.81	0.04	2.85	1.84	3.24	34.66	0.01	0.00	100.47
95dst13-23alm	37.39	0.11	20.86	0.03	3.81	2.11	1.91	34.16	0.00	0.02	100.42
95dst13-24alm	37.39	0.12	20.68	0.03	3.50	2.45	2.09	33.78	0.00	0.00	100.04

Crustal Garnet - Almandine (Continued)											
Sample	**SiO2**	**TiO2**	**Al2O3**	**Cr2O3**	**MgO**	**CaO**	**MnO**	**FeO**	**Na2O**	**K2O**	**Total**
95dst13-25alm	37.08	0.12	20.65	0.03	2.98	2.34	2.37	34.45	0.00	0.00	100.02
95dst19-1alm	36.73	0.24	20.32	0.03	1.03	2.57	7.99	31.55	0.01	0.00	100.47
95dst19-2alm	36.68	0.19	20.38	0.05	1.37	2.34	5.43	34.02	0.00	0.00	100.46
95dst19-3alm	36.69	0.10	20.31	0.01	1.17	4.33	8.12	29.43	0.00	0.00	100.16
95dst19-4alm	36.85	0.08	20.45	0.03	1.07	2.53	6.19	33.47	0.00	0.00	100.67
95dst19-5alm	36.33	0.14	20.41	0.03	1.36	2.04	7.22	32.52	0.01	0.00	100.04
95dst19-6alm	36.56	0.12	20.32	0.04	1.32	1.89	7.05	32.88	0.00	0.00	100.19
96dst201-21prp	36.83	0.05	20.81	0.04	2.53	2.19	7.40	30.05	0.02	0.00	99.93
96dst201-22prp	37.04	0.10	20.89	0.05	2.15	3.00	9.40	27.71	0.00	0.00	100.34
97dst02-2gp	39.38	0.08	21.71	0.01	7.35	9.57	0.52	22.21	0.01	0.00	100.85
97dst04-30alm	37.25	0.03	20.54	0.05	2.84	3.24	0.51	36.11	0.02	0.00	100.60
97dst05-32go	38.80	0.07	21.34	0.00	6.30	7.48	0.87	25.31	0.01	0.00	100.18
97dst05-33go	38.35	0.20	20.83	0.01	6.06	8.44	0.61	25.22	0.00	0.00	99.73
97dst09-9go	39.12	0.14	21.59	0.00	8.57	6.62	0.43	23.66	0.01	0.00	100.14
97dst09-10go	39.22	0.08	21.81	0.01	8.91	6.51	0.55	23.07	0.00	0.00	100.16
97dst09-11go	39.40	0.10	21.51	0.06	9.25	6.89	0.48	22.48	0.00	0.00	100.16
97dst100-10go	39.19	0.11	21.91	0.00	7.92	8.27	0.39	22.43	0.01	0.00	100.24
97dst100-11go	39.08	0.18	21.76	0.01	7.28	8.48	0.76	22.50	0.05	0.00	100.10
97dst100-14go	39.18	0.30	21.83	0.05	9.38	6.41	0.63	22.30	0.02	0.00	100.10
97dst100-15alm	38.16	0.07	21.25	0.00	3.94	5.91	1.12	30.57	0.01	0.00	101.03
97dst100-16alm	36.59	0.10	20.36	0.00	0.34	2.66	16.79	23.65	0.01	0.01	100.50
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
97dst100-19alm	37.05	0.20	20.65	0.04	0.97	5.46	9.19	26.83	0.02	0.00	100.40
97dst100-20alm	38.75	0.02	21.51	0.02	8.87	2.16	2.31	26.66	0.01	0.00	100.30
97dst100-22alm(d)	37.33	0.10	20.27	0.00	1.39	9.85	1.32	29.97	0.01	0.00	100.25
97dst100-22alm	37.22	0.08	20.11	0.00	1.42	9.68	1.28	30.38	0.00	0.00	100.18
97dst101-18go	39.12	0.11	21.69	0.01	7.65	8.84	0.51	22.61	0.02	0.01	100.58
97dst101-19go	38.82	0.22	21.82	0.04	8.11	5.78	0.31	25.41	0.01	0.00	100.53
97dst101-23alm	36.94	0.03	21.07	0.00	3.92	0.86	4.94	32.14	0.02	0.01	99.92
97dst101-24alm	37.64	0.00	21.14	0.01	5.58	0.52	2.10	33.20	0.00	0.00	100.20
97dst101-25alm	38.25	0.18	21.15	0.01	5.51	6.54	0.62	28.09	0.00	0.00	100.36
97dst101-26alm	37.40	0.01	20.96	0.04	4.15	2.14	0.49	35.20	0.02	0.00	100.39
97dst101-27alm	37.80	0.07	20.97	0.02	3.38	7.33	1.23	29.44	0.00	0.00	100.25
97dst101-28alm	38.33	0.13	21.00	0.01	4.23	9.15	1.26	25.93	0.00	0.00	100.03
97dst101-29alm	38.49	0.03	21.31	0.21	7.27	2.57	0.85	29.27	0.02	0.00	100.01
97dst101-30alm	37.50	0.05	20.57	0.02	2.25	7.44	1.26	31.26	0.00	0.00	100.34
97dst101-31alm	38.02	0.04	21.09	0.03	6.36	1.35	1.35	31.70	0.00	0.00	99.96
97dst101-32alm	36.93	0.03	20.65	0.02	2.55	3.65	0.69	35.37	0.00	0.00	99.87
97dst101-34alm	37.15	0.04	20.34	0.00	1.35	6.50	1.24	33.55	0.03	0.00	100.19

Crustal Garnet - Almandine (Continued)											
Sample	**SiO2**	**TiO2**	**Al2O3**	**Cr2O3**	**MgO**	**CaO**	**MnO**	**FeO**	**Na2O**	**K2O**	**Total**
95dst13-25alm	37.08	0.12	20.65	0.03	2.98	2.34	2.37	34.45	0.00	0.00	100.02
95dst19-1alm	36.73	0.24	20.32	0.03	1.03	2.57	7.99	31.55	0.01	0.00	100.47
95dst19-2alm	36.68	0.19	20.38	0.05	1.37	2.34	5.43	34.02	0.00	0.00	100.46
95dst19-3alm	36.69	0.10	20.31	0.01	1.17	4.33	8.12	29.43	0.00	0.00	100.16
95dst19-4alm	36.85	0.08	20.45	0.03	1.07	2.53	6.19	33.47	0.00	0.00	100.67
95dst19-5alm	36.33	0.14	20.41	0.03	1.36	2.04	7.22	32.52	0.01	0.00	100.04
95dst19-6alm	36.56	0.12	20.32	0.04	1.32	1.89	7.05	32.88	0.00	0.00	100.19
96dst201-21prp	36.83	0.05	20.81	0.04	2.53	2.19	7.40	30.05	0.02	0.00	99.93
96dst201-22prp	37.04	0.10	20.89	0.05	2.15	3.00	9.40	27.71	0.00	0.00	100.34
97dst02-2gp	39.38	0.08	21.71	0.01	7.35	9.57	0.52	22.21	0.01	0.00	100.85
97dst04-30alm	37.25	0.03	20.54	0.05	2.84	3.24	0.51	36.11	0.02	0.00	100.60
97dst05-32go	38.80	0.07	21.34	0.00	6.30	7.48	0.87	25.31	0.01	0.00	100.18
97dst05-33go	38.35	0.20	20.83	0.01	6.06	8.44	0.61	25.22	0.00	0.00	99.73
97dst09-9go	39.12	0.14	21.59	0.00	8.57	6.62	0.43	23.66	0.01	0.00	100.14
97dst09-10go	39.22	0.08	21.81	0.01	8.91	6.51	0.55	23.07	0.00	0.00	100.16
97dst09-11go	39.40	0.10	21.51	0.06	9.25	6.89	0.48	22.48	0.00	0.00	100.16
97dst100-10go	39.19	0.11	21.91	0.00	7.92	8.27	0.39	22.43	0.01	0.00	100.24
97dst100-11go	39.08	0.18	21.76	0.01	7.28	8.48	0.76	22.50	0.05	0.00	100.10
97dst100-14go	39.18	0.30	21.83	0.05	9.38	6.41	0.63	22.30	0.02	0.00	100.10
97dst100-15alm	38.16	0.07	21.25	0.00	3.94	5.91	1.12	30.57	0.01	0.00	101.03
97dst100-16alm	36.59	0.10	20.36	0.00	0.34	2.66	16.79	23.65	0.01	0.01	100.50
97dst100-18alm	**36.80**	**0.17**	**20.32**	**0.01**	**0.28**	**4.62**	**17.56**	**20.27**	**0.00**	**0.01**	**100.04**
97dst100-19alm	37.05	0.20	20.65	0.04	0.97	5.46	9.19	26.83	0.02	0.00	100.40
97dst100-20alm	38.75	0.02	21.51	0.02	8.87	2.16	2.31	26.66	0.01	0.00	100.30
97dst100-22alm(d)	37.33	0.10	20.27	0.00	1.39	9.85	1.32	29.97	0.01	0.00	100.25
97dst100-22alm	37.22	0.08	20.11	0.00	1.42	9.68	1.28	30.38	0.00	0.00	100.18
97dst101-18go	39.12	0.11	21.69	0.01	7.65	8.84	0.51	22.61	0.02	0.01	100.58
97dst101-19go	38.82	0.22	21.82	0.04	8.11	5.78	0.31	25.41	0.01	0.00	100.53
97dst101-23alm	36.94	0.03	21.07	0.00	3.92	0.86	4.94	32.14	0.02	0.01	99.92
97dst101-24alm	37.64	0.00	21.14	0.01	5.58	0.52	2.10	33.20	0.00	0.00	100.20
97dst101-25alm	38.25	0.18	21.15	0.01	5.51	6.54	0.62	28.09	0.00	0.00	100.36
97dst101-26alm	37.40	0.01	20.96	0.04	4.15	2.14	0.49	35.20	0.02	0.00	100.39
97dst101-27alm	37.80	0.07	20.97	0.02	3.38	7.33	1.23	29.44	0.00	0.00	100.25
97dst101-28alm	38.33	0.13	21.00	0.01	4.23	9.15	1.26	25.93	0.00	0.00	100.03
97dst101-29alm	38.49	0.03	21.31	0.21	7.27	2.57	0.85	29.27	0.02	0.00	100.01
97dst101-30alm	37.50	0.05	20.57	0.02	2.25	7.44	1.26	31.26	0.00	0.00	100.34
97dst101-31alm	38.02	0.04	21.09	0.03	6.36	1.35	1.35	31.70	0.00	0.00	99.96
97dst101-32alm	36.93	0.03	20.65	0.02	2.55	3.65	0.69	35.37	0.00	0.00	99.87
97dst101-34alm	37.15	0.04	20.34	0.00	1.35	6.50	1.24	33.55	0.03	0.00	100.19

Crustal Garnet - Almandine (Continued)											
Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
97dst102-24go	39.50	0.23	21.61	0.07	9.83	5.82	0.53	22.70	0.01	0.00	100.28
97dst102-25go	39.27	0.11	21.64	0.02	8.59	6.87	0.51	23.26	0.02	0.00	100.29
97dst102-28go	38.43	0.14	20.78	0.01	7.22	6.27	0.78	26.28	0.02	0.00	99.92
97dst103-70gp	38.51	0.02	21.61	0.07	8.68	1.66	2.15	27.38	0.00	0.00	100.09
97dst103-77gp	38.32	0.01	21.59	0.01	8.00	1.76	0.33	30.02	0.01	0.00	100.06
97dst103-78alm	38.22	0.01	21.25	0.02	6.55	4.70	1.60	27.20	0.00	0.00	99.55
97dst105-51go	37.59	0.04	21.06	0.03	4.51	2.16	0.93	34.32	0.01	0.00	100.66
97dst105-52alm	38.28	0.01	20.98	0.00	6.21	6.22	1.10	27.47	0.00	0.00	100.27
97dst105-53alm	37.81	0.05	21.10	0.04	6.53	1.59	2.38	30.34	0.02	0.01	99.87
97dst105-54alm	37.97	0.00	21.65	0.03	7.93	0.86	0.88	30.92	0.01	0.00	100.24
97dst105-56alm	37.98	0.00	21.20	0.05	6.71	1.07	1.09	31.67	0.02	0.01	99.80
97dst105-57alm	38.12	0.08	21.37	0.10	7.26	1.64	1.18	30.46	0.00	0.00	100.21
97dst105-58alm	37.79	0.02	21.02	0.03	6.20	2.21	1.65	31.00	0.01	0.00	99.93
97dst108-21alm	36.96	0.03	20.54	0.04	3.55	2.15	0.37	36.18	0.01	0.00	99.84
98dst100-al2	36.70	0.00	20.28	0.03	0.80	2.49	1.40	39.04	0.00	0.00	100.75
98dst100-al3	37.97	0.00	21.13	0.04	5.31	2.94	1.88	31.42	0.00	0.00	100.70
98dst303-gr2	38.94	0.03	22.00	0.01	9.56	1.04	0.51	28.46	0.01	0.00	100.56
00-DST-108-bcde-14	37.08	0.04	20.47	0.00	2.46	3.54	0.12	36.55	0.00	0.00	100.27
00-DST-205A-01	**39.99**	**0.12**	**21.72**	**0.07**	**10.86**	**5.81**	**0.54**	**21.02**	**0.00**	**0.00**	**100.14**

CHROMITE

☐ possibly kimberlitic chromite

Chromite Unique to Lamproite and Kimberlite															
Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
96dst03-42c	**0.06**	**3.45**	**0.04**	**10.16**	**44.88**	**0.13**	**11.07**	**0.26**	**28.61**	**0.19**	**0.09**	**98.95**	**10.15**	**19.48**	**99.97**

Chromite															
Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
96dst01-21c	**0.00**	**0.23**	**0.00**	**7.92**	**55.84**	**0.18**	**6.26**	**0.55**	**27.55**	**0.13**	**0.15**	**98.80**	**4.92**	**23.12**	**99.29**
96dst01-22c	0.03	0.59	0.01	17.82	50.23	0.22	9.16	0.47	19.74	0.03	1.37	99.66	0.00	19.74	99.66
96dst01-23c	0.00	0.34	0.00	14.42	53.19	0.18	12.27	0.23	18.99	0.07	0.00	99.69	3.50	15.84	100.04
96dst01-24c	0.00	0.25	0.00	11.08	54.59	0.15	5.12	0.13	28.16	0.08	0.11	99.67	2.31	26.08	99.90
96dst01-25c	0.03	0.31	0.01	15.68	52.69	0.17	8.19	0.55	21.12	0.02	0.84	99.62	0.00	21.12	99.62
96dst01-26c	0.02	0.25	0.00	14.48	52.97	0.15	7.53	0.46	23.16	0.07	0.45	99.54	0.99	22.26	99.64
96dst03-28c	0.00	0.50	0.02	17.16	51.18	0.25	9.33	0.48	20.15	0.00	0.64	99.70	0.00	20.15	99.70
96dst03-29c	0.01	0.26	0.00	10.90	52.04	0.25	3.76	0.33	31.49	0.12	0.51	99.68	4.18	27.73	100.09
96dst03-30c	0.00	0.31	0.00	15.07	52.39	0.24	7.32	0.67	21.98	0.06	0.66	98.70	0.00	21.98	98.70
96dst03-31c	0.02	0.29	0.00	9.62	53.76	0.32	3.46	0.28	31.66	0.06	0.16	99.62	3.46	28.54	99.97
96dst03-32c	0.03	0.59	0.05	13.34	51.37	0.19	4.08	0.21	29.48	0.09	0.17	99.59	1.32	28.29	99.72
96dst03-33c	**0.00**	**0.53**	**0.00**	**10.24**	**51.32**	**0.20**	**2.95**	**0.31**	**33.46**	**0.16**	**0.19**	**99.38**	**4.73**	**29.21**	**99.85**
96dst03-34c	0.00	0.44	0.00	10.61	51.69	0.18	2.71	0.29	33.19	0.08	0.17	99.36	3.96	29.63	99.76
96dst03-35c	**0.01**	**0.28**	**0.00**	**12.53**	**55.86**	**0.18**	**11.54**	**0.20**	**18.88**	**0.13**	**0.09**	**99.70**	**2.64**	**16.50**	**99.97**

Chromite														
Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
96dst03-36c	0.02	0.25	0.01	8.28	55.66	0.21	2.83	0.71	30.75	0.05	0.21	98.97	2.59	28.42	99.23
96dst03-37c	**0.04**	**0.24**	**0.00**	**9.95**	**59.11**	**0.19**	**7.48**	**0.75**	**20.94**	**0.03**	**0.67**	**99.40**	**0.00**	**20.94**	**99.40**
96dst03-38c	**0.00**	**0.65**	**0.01**	**8.43**	**53.30**	**0.16**	**2.90**	**2.34**	**30.79**	**0.15**	**0.20**	**98.94**	**4.34**	**26.88**	**99.38**
96dst03-39c	0.00	0.45	0.06	12.09	53.98	0.22	9.75	0.26	22.88	0.12	0.15	99.96	3.84	19.43	100.35
96dst03-40c	0.01	0.49	0.05	17.63	50.90	0.16	9.34	0.41	19.58	0.00	0.97	99.54	0.00	19.58	99.54
96dst03-41c	0.02	0.69	0.00	15.44	46.11	0.24	2.59	0.33	33.85	0.03	0.31	99.61	3.31	30.87	99.94
96dst03-43c	0.02	0.25	0.08	13.59	53.74	0.15	3.28	0.24	28.50	0.10	0.37	100.33	0.00	28.50	100.33
96dst03-44c	0.05	0.21	0.00	12.08	54.74	0.09	7.50	0.25	24.06	0.08	0.08	99.14	1.98	22.27	99.34
96dst202-10c	0.01	0.26	0.00	13.34	52.51	0.31	1.29	0.17	31.53	0.03	0.80	100.25	0.00	31.53	100.25
96dst202-5c	0.04	0.31	0.00	15.07	49.03	0.21	2.78	0.19	31.16	0.09	0.46	99.33	1.32	29.97	99.46
96dst202-6c	0.01	0.49	0.02	13.76	47.69	0.18	1.31	0.48	35.00	0.09	0.38	99.41	3.39	31.95	99.75
96dst202-7c	0.00	0.23	0.00	9.11	52.20	0.17	2.31	0.40	34.49	0.08	0.14	99.12	5.36	29.67	99.66
96dst202-8c	0.02	0.32	0.03	15.17	50.31	0.19	1.53	0.20	31.44	0.07	0.66	99.93	0.00	31.44	99.93
96dst202-9c	0.02	0.46	0.00	9.32	52.21	0.21	0.69	0.30	35.14	0.07	1.07	99.50	3.71	31.81	99.87
97dst103-54	0.00	0.23	0.03	15.27	53.71	0.14	13.24	0.28	16.27	0.09	0.05	99.31	2.45	14.07	99.56
97dst105-34	**0.00**	**0.21**	**0.01**	**10.63**	**47.65**	**0.17**	**6.72**	**0.49**	**32.84**	**0.15**	**0.05**	**98.93**	**10.81**	**23.11**	**100.01**
97dst105-35	0.01	0.73	0.00	18.66	45.23	0.15	10.06	0.37	23.65	0.11	0.10	99.06	4.33	19.75	99.50
97dst108-19	**0.10**	**0.13**	**0.00**	**54.18**	**13.52**	**0.11**	**19.01**	**0.09**	**11.34**	**0.35**	**0.07**	**98.90**	**0.25**	**11.11**	**98.93**
98dst02-cr1	0.00	0.25	0.00	16.51	53.84	0.10	14.51	0.16	13.62	0.12	0.08	99.20	1.50	12.27	99.35
98dst04-cr2	**0.00**	**0.37**	**0.00**	**9.02**	**46.83**	**0.13**	**5.49**	**0.41**	**35.75**	**0.16**	**0.31**	**98.45**	**12.49**	**24.50**	**99.70**
98dst102-cr3	**0.00**	**0.19**	**0.01**	**10.09**	**56.51**	**0.15**	**8.45**	**0.49**	**23.51**	**0.05**	**0.27**	**99.72**	**3.52**	**20.35**	**100.08**
98dst102-cr4	0.00	0.26	0.04	14.03	49.63	0.16	9.95	0.48	24.61	0.11	0.08	99.35	6.43	18.83	100.00
98dst300-cr5	0.00	0.24	0.00	16.64	53.16	0.11	13.70	0.23	14.67	0.09	0.04	98.90	1.37	13.45	99.03
98dst302-13	**0.00**	**4.73**	**0.00**	**20.81**	**35.92**	**0.22**	**10.46**	**0.26**	**27.33**	**0.21**	**0.12**	**100.06**	**4.27**	**23.49**	**100.49**
99-DST-36-01	**0.08**	**0.18**	**0.00**	**16.35**	**54.28**	**0.10**	**13.92**	**0.21**	**14.61**	**0.10**	**0.06**	**99.87**	**1.35**	**13.40**	**100.01**
99-DST-37-01	0.07	0.41	0.00	14.53	51.67	0.19	9.93	0.31	22.20	0.16	0.08	99.55	3.23	19.30	99.87
99-DST-39-02	0.07	0.17	0.03	22.95	42.88	0.18	11.15	0.38	22.00	0.10	0.18	100.10	3.73	18.64	100.47
99-DST-44-02	**0.13**	**2.70**	**0.00**	**6.89**	**56.53**	**0.10**	**13.10**	**0.28**	**19.02**	**0.22**	**0.07**	**99.03**	**4.35**	**15.10**	**99.47**
99-DST-101-02	**0.13**	**0.30**	**0.00**	**11.90**	**51.15**	**0.20**	**4.68**	**0.58**	**30.00**	**0.15**	**0.37**	**99.46**	**4.02**	**26.38**	**99.86**
00-DST-07-02	0.10	0.40	0.01	11.85	39.02	0.47	0.31	0.94	44.87	0.01	0.61	98.58	13.22	32.97	99.90
00-DST-07-03	0.06	0.14	0.00	14.19	52.82	0.15	10.62	0.39	20.88	0.14	0.16	99.56	3.49	17.74	99.90
00-DST-07-04	0.07	0.57	0.03	15.74	48.61	0.19	8.68	0.30	25.42	0.09	0.06	99.76	4.05	21.77	100.16
00-DST-07-05	**0.07**	**0.21**	**0.00**	**16.80**	**52.85**	**0.12**	**13.98**	**0.19**	**15.23**	**0.15**	**0.05**	**99.63**	**2.10**	**13.34**	**99.84**
00-DST-08-04	0.08	0.32	0.01	13.03	49.63	0.16	2.71	0.78	32.32	0.09	0.30	99.43	3.29	29.36	99.76
00-DST-16-01	0.06	0.55	0.00	19.20	42.74	0.23	6.58	0.45	29.52	0.09	0.27	99.69	4.82	25.18	100.18
00-DST-16-02	0.11	0.44	0.00	15.42	50.10	0.17	10.69	0.21	22.35	0.10	0.08	99.67	4.23	18.54	100.10
00-DST-16-03	0.07	0.43	0.00	12.90	48.41	0.22	5.35	0.36	30.95	0.05	0.12	98.87	5.54	25.97	99.42
00-DST-16-04	**0.16**	**0.34**	**0.00**	**16.91**	**47.61**	**0.10**	**12.41**	**0.17**	**21.42**	**0.18**	**0.05**	**99.35**	**6.10**	**15.93**	**99.96**
00-DST-16-05	**0.09**	**0.36**	**0.00**	**11.73**	**55.43**	**0.19**	**10.21**	**0.31**	**21.31**	**0.10**	**0.08**	**99.81**	**3.06**	**18.56**	**100.11**

Crustal Garnet - Almandine (Continued)										
Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
97dst102-24go	39.50	0.23	21.61	0.07	9.83	5.82	0.53	22.70	0.01	0.00	100.28
97dst102-25go	39.27	0.11	21.64	0.02	8.59	6.87	0.51	23.26	0.02	0.00	100.29
97dst102-28go	38.43	0.14	20.78	0.01	7.22	6.27	0.78	26.28	0.02	0.00	99.92
97dst103-70gp	38.51	0.02	21.61	0.07	8.68	1.66	2.15	27.38	0.00	0.00	100.09
97dst103-77gp	38.32	0.01	21.59	0.01	8.00	1.76	0.33	30.02	0.01	0.00	100.06
97dst103-78alm	38.22	0.01	21.25	0.02	6.55	4.70	1.60	27.20	0.00	0.00	99.55
97dst105-51go	37.59	0.04	21.06	0.03	4.51	2.16	0.93	34.32	0.01	0.00	100.66
97dst105-52alm	38.28	0.01	20.98	0.00	6.21	6.22	1.10	27.47	0.00	0.00	100.27
97dst105-53alm	37.81	0.05	21.10	0.04	6.53	1.59	2.38	30.34	0.02	0.01	99.87
97dst105-54alm	37.97	0.00	21.65	0.03	7.93	0.86	0.88	30.92	0.01	0.00	100.24
97dst105-56alm	37.98	0.00	21.20	0.05	6.71	1.07	1.09	31.67	0.02	0.01	99.80
97dst105-57alm	38.12	0.08	21.37	0.10	7.26	1.64	1.18	30.46	0.00	0.00	100.21
97dst105-58alm	37.79	0.02	21.02	0.03	6.20	2.21	1.65	31.00	0.01	0.00	99.93
97dst108-21alm	36.96	0.03	20.54	0.04	3.55	2.15	0.37	36.18	0.01	0.00	99.84
98dst100-al2	36.70	0.00	20.28	0.03	0.80	2.49	1.40	39.04	0.00	0.00	100.75
98dst100-al3	37.97	0.00	21.13	0.04	5.31	2.94	1.88	31.42	0.00	0.00	100.70
98dst303-gr2	38.94	0.03	22.00	0.01	9.56	1.04	0.51	28.46	0.01	0.00	100.56
00-DST-108-bcde-14	37.08	0.04	20.47	0.00	2.46	3.54	0.12	36.55	0.00	0.00	100.27
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100.14

CHROMITE

▨ possibly kimberlitic chromite

Chromite Unique to Lamproite and Kimberlite														
Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
[illegible]	0.38	3.46	0.04	10.16	44.66	0.13	11.07	0.26	28.01	0.19	0.09	99.95	10.15	19.48	99.97

Chromite															
Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
96dst01-21c	0.00	0.29	0.00	7.92	56.84	0.16	8.28	0.55	27.55	0.13	0.15	98.80	4.92	23.12	99.29
96dst01-22c	0.03	0.59	0.01	17.82	50.23	0.22	9.16	0.47	19.74	0.03	1.37	99.66	0.00	19.74	99.66
96dst01-23c	0.00	0.34	0.00	14.42	53.19	0.18	12.27	0.23	18.99	0.07	0.00	99.69	3.50	15.84	100.04
96dst01-24c	0.00	0.25	0.00	11.08	54.59	0.15	5.12	0.13	28.16	0.08	0.11	99.67	2.31	26.08	99.90
96dst01-25c	0.03	0.31	0.01	15.68	52.69	0.17	8.19	0.55	21.12	0.02	0.84	99.62	0.00	21.12	99.62
96dst01-26c	0.02	0.25	0.00	14.48	52.97	0.15	7.53	0.46	23.16	0.07	0.45	99.54	0.99	22.26	99.64
96dst03-28c	0.00	0.50	0.02	17.16	51.18	0.25	9.33	0.48	20.15	0.00	0.64	99.70	0.00	20.15	99.70
96dst03-29c	0.01	0.26	0.00	10.90	52.04	0.25	3.76	0.33	31.49	0.12	0.51	99.68	4.18	27.73	100.09
96dst03-30c	0.00	0.31	0.00	15.07	52.39	0.24	7.32	0.67	21.98	0.06	0.66	98.70	0.00	21.98	98.70
96dst03-31c	0.02	0.29	0.00	9.62	53.76	0.32	3.46	0.28	31.66	0.06	0.16	99.62	3.46	28.54	99.97
96dst03-32c	0.03	0.59	0.05	13.34	51.37	0.19	4.08	0.21	29.48	0.09	0.17	99.59	1.32	28.29	99.72
[illegible]	0.00	0.53	0.00	10.24	51.32	0.20	2.58	0.31	33.40	0.16	0.18	99.35	4.73	29.21	99.85
96dst03-34c	0.00	0.44	0.00	10.61	51.69	0.18	2.71	0.29	33.19	0.08	0.17	99.36	3.96	29.63	99.76
[illegible]	0.01	0.28	0.00	11.56	54.56	0.15	11.44	0.20	18.60	0.13	0.09	99.70	2.04	16.50	99.97

Chromite															
Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
96dst03-36c	0.02	0.25	0.01	8.28	55.66	0.21	2.83	0.71	30.75	0.05	0.21	98.97	2.59	28.42	99.23
96dst03-37c	0.04	0.24	0.00	9.95	59.11	0.19	7.48	0.75	20.94	0.03	0.67	99.40	0.00	20.94	99.40
96dst03-38c	0.00	0.65	0.01	8.43	53.30	0.16	2.90	2.34	30.79	0.15	0.20	98.94	4.34	26.88	99.38
96dst03-39c	0.00	0.45	0.06	12.09	53.98	0.22	9.75	0.26	22.88	0.12	0.15	99.96	3.84	19.43	100.35
96dst03-40c	0.01	0.49	0.05	17.63	50.90	0.16	9.34	0.41	19.58	0.00	0.97	99.54	0.00	19.58	99.54
96dst03-41c	0.02	0.69	0.00	15.44	46.11	0.24	2.59	0.33	33.85	0.03	0.31	99.61	3.31	30.87	99.94
96dst03-43c	0.02	0.25	0.08	13.59	53.74	0.15	3.28	0.24	28.50	0.10	0.37	100.33	0.00	28.50	100.33
96dst03-44c	0.05	0.21	0.00	12.08	54.74	0.09	7.50	0.25	24.06	0.08	0.08	99.14	1.98	22.27	99.34
96dst202-10c	0.01	0.26	0.00	13.34	52.51	0.31	1.29	0.17	31.53	0.03	0.80	100.25	0.00	31.53	100.25
96dst202-5c	0.04	0.31	0.00	15.07	49.03	0.21	2.78	0.19	31.16	0.09	0.46	99.33	1.32	29.97	99.46
96dst202-6c	0.01	0.49	0.02	13.76	47.69	0.18	1.31	0.48	35.00	0.09	0.38	99.41	3.39	31.95	99.75
96dst202-7c	0.00	0.23	0.00	9.11	52.20	0.17	2.31	0.40	34.49	0.08	0.14	99.12	5.36	29.67	99.66
96dst202-8c	0.02	0.32	0.03	15.17	50.31	0.19	1.53	0.20	31.44	0.07	0.66	99.93	0.00	31.44	99.93
96dst202-9c	0.02	0.46	0.00	9.32	52.21	0.21	0.69	0.30	35.14	0.07	1.07	99.50	3.71	31.81	99.87
97dst103-54	0.00	0.23	0.03	15.27	53.71	0.14	13.24	0.28	16.27	0.09	0.05	99.31	2.45	14.07	99.56
97dst105-34	0.00	0.21	0.01	10.63	47.66	0.17	6.72	0.49	32.84	0.15	0.05	98.93	10.81	23.11	100.01
97dst105-35	0.01	0.73	0.00	18.66	45.23	0.15	10.06	0.37	23.65	0.11	0.10	99.06	4.33	19.75	99.50
97dst106-13	0.10	0.13	0.00	54.18	13.52	0.11	19.01	0.09	11.34	0.35	0.07	98.90	0.25	11.11	98.93
98dst02-cr1	0.00	0.25	0.00	16.51	53.84	0.10	14.51	0.16	13.62	0.12	0.08	99.20	1.50	12.27	99.35
98dst04-cr2	0.00	0.37	0.00	9.02	46.83	0.13	5.49	0.41	35.75	0.16	0.31	98.45	12.49	24.50	99.70
98dst102-cr3	0.00	0.19	0.01	10.09	56.51	0.15	8.45	0.49	23.51	0.05	0.27	99.72	3.52	20.35	100.08
98dst102-cr4	0.00	0.26	0.04	14.03	49.63	0.16	9.95	0.48	24.61	0.11	0.08	99.35	6.43	18.83	100.00
98dst300-cr5	0.00	0.24	0.00	16.64	53.16	0.11	13.70	0.23	14.67	0.09	0.04	98.90	1.37	13.45	99.03
98dst302-13	0.00	4.73	0.00	20.81	35.92	0.22	10.46	0.26	27.33	0.21	0.12	100.06	4.27	23.49	100.49
99-DST-36-01	0.06	0.18	0.00	16.35	54.28	0.10	13.92	0.21	14.61	0.10	0.06	99.87	1.35	13.40	100.01
99-DST-37-01	0.07	0.41	0.00	14.53	51.67	0.19	9.93	0.31	22.20	0.16	0.08	99.55	3.23	19.30	99.87
99-DST-39-02	0.07	0.17	0.03	22.95	42.88	0.18	11.15	0.38	22.00	0.10	0.18	100.10	3.73	18.64	100.47
99-DST-44-02	0.13	2.70	0.00	6.89	56.53	0.10	13.10	0.28	19.02	0.22	0.07	99.03	4.35	15.10	99.47
99-DST-101-02	0.13	0.30	0.00	11.90	51.15	0.20	4.68	0.58	30.00	0.15	0.37	99.46	4.02	26.38	99.86
00-DST-07-02	0.10	0.40	0.01	11.85	39.02	0.47	0.31	0.94	44.87	0.01	0.61	98.58	13.22	32.97	99.90
00-DST-07-03	0.06	0.14	0.00	14.19	52.82	0.15	10.62	0.39	20.88	0.14	0.16	99.56	3.49	17.74	99.90
00-DST-07-04	0.07	0.57	0.03	15.74	48.61	0.19	8.68	0.30	25.42	0.09	0.06	99.76	4.05	21.77	100.16
00-DST-07-05	0.07	0.21	0.00	16.80	52.85	0.12	13.96	0.19	15.23	0.15	0.05	99.63	2.10	13.34	99.84
00-DST-08-04	0.08	0.32	0.01	13.03	49.63	0.16	2.71	0.78	32.32	0.09	0.30	99.43	3.29	29.36	99.76
00-DST-16-01	0.06	0.55	0.00	19.20	42.74	0.23	6.58	0.45	29.52	0.09	0.27	99.69	4.82	25.18	100.18
00-DST-16-02	0.11	0.44	0.00	15.42	50.10	0.17	10.69	0.21	22.35	0.10	0.08	99.67	4.23	18.54	100.10
00-DST-16-03	0.07	0.43	0.00	12.90	48.41	0.22	5.35	0.36	30.95	0.05	0.12	98.87	5.54	25.97	99.42
00-DST-16-04	0.16	0.34	0.00	16.91	47.61	0.10	12.41	0.17	21.42	0.16	0.05	99.35	6.10	15.93	99.96
00-DST-16-05	0.09	0.36	0.00	11.73	55.43	0.19	10.21	0.31	21.31	0.10	0.08	99.81	3.06	18.56	100.11

Chromite continued

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
00-DST-16-06	0.07	0.20	0.02	16.64	53.46	0.15	13.36	0.33	14.77	0.11	0.04	99.16	0.81	14.05	99.24
00-DST-100-02	0.09	0.23	0.00	17.68	50.70	0.14	14.14	0.27	15.88	0.14	0.06	99.33	3.05	13.14	99.64
00-DST-108-bcde-21	0.10	0.49	0.00	15.07	50.77	0.24	10.66	0.20	22.32	0.04	0.08	99.96	3.87	18.83	100.35
00-DST-108-bcde-22	0.05	0.23	0.00	22.87	46.67	0.16	14.25	0.22	15.49	0.10	0.06	100.10	1.55	14.09	100.26
00-DST-108-bcde-24	0.11	0.36	0.01	15.72	49.24	0.20	8.65	0.31	25.34	0.06	0.06	100.04	3.98	21.76	100.44
00-DST-108-bcde-48	**0.08**	**0.20**	**0.00**	**16.67**	**49.90**	**0.09**	**11.60**	**0.34**	**20.48**	**0.13**	**0.12**	**99.60**	**4.15**	**16.74**	**100.02**
00-DST-110-01	0.10	0.42	0.00	9.14	45.64	0.07	5.03	0.40	37.11	0.09	0.25	98.25	13.03	25.38	99.56
00-DST-200-01	0.05	0.19	0.04	21.73	47.01	0.17	13.43	0.32	16.80	0.14	0.07	99.93	2.02	14.98	100.13
00-DST-201-01	**0.24**	**0.59**	**0.00**	**33.05**	**34.96**	**0.15**	**15.90**	**0.11**	**13.48**	**0.25**	**0.04**	**98.74**	**0.26**	**13.25**	**98.77**
00-DST-202-01	0.07	0.43	0.00	14.60	51.66	0.20	10.95	0.21	21.63	0.13	0.05	99.92	3.94	18.08	100.31
00-DST-206-03	0.10	0.23	0.06	21.49	42.12	0.27	9.84	0.52	24.83	0.13	0.11	99.69	4.87	20.45	100.17
00-DST-206-04	0.07	0.13	0.01	19.33	48.56	0.23	12.75	0.23	18.36	0.13	0.07	99.88	2.87	15.77	100.17
00-DST-206-05	0.07	0.32	0.00	14.49	49.56	0.20	10.35	0.43	23.72	0.10	0.10	99.36	5.83	18.48	99.94
00-DST-206-06	**0.06**	**0.19**	**0.00**	**17.04**	**52.67**	**0.15**	**14.68**	**0.19**	**14.26**	**0.12**	**0.04**	**99.39**	**2.20**	**12.28**	**99.61**
00-DST-206-07	0.05	0.18	0.00	21.56	46.59	0.15	13.50	0.22	17.59	0.11	0.07	100.01	2.95	14.93	100.31
00-DST-206-12	0.08	0.36	0.00	17.20	49.80	0.12	12.93	0.31	17.91	0.13	0.03	98.86	3.39	14.86	99.20
00-DST-210-01	**0.06**	**1.37**	**0.00**	**3.39**	**54.32**	**0.46**	**8.11**	**0.42**	**30.05**	**0.14**	**0.12**	**98.45**	**9.79**	**21.25**	**99.43**
01-DST-04-01	0.09	0.53	0.00	17.16	48.53	0.18	8.14	1.04	23.14	0.09	0.51	99.40	1.89	21.44	99.59
01-DST-04-02	0.08	0.49	0.06	15.85	51.23	0.22	10.70	0.93	19.86	0.10	0.38	99.90	2.32	17.77	100.14
01-DST-04-03	0.09	0.41	0.06	15.56	52.32	0.18	11.89	0.87	17.87	0.09	0.29	99.63	2.24	15.85	99.86
01-DST-04-04	0.08	0.57	0.00	16.64	49.87	0.22	10.49	0.99	20.03	0.10	0.48	99.46	2.32	17.94	99.69

ILMENITE

Mg-rich Ilmenite (kimberlitic affinity, > 4 wt% MgO)

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total	ilmenite	geikilite	hematite
95dst120-7i	0.02	50.87	0.09	0.16	3.11	0.26	10.25	0.29	33.68	0.14	0.02	98.90	6.80	27.56	99.58	56.38	37.36	6.25
95dst24-5i	0.00	51.05	0.15	0.14	3.91	0.29	10.37	0.33	32.69	0.15	0.00	99.08	5.70	27.56	99.65	56.72	38.02	5.27
96dst02-8i	0.01	49.45	0.12	0.07	2.56	0.20	8.56	0.34	37.50	0.09	0.00	98.91	9.17	29.25	99.82	60.14	31.37	8.49
96dst03-45i	0.00	49.63	0.19	0.06	1.77	0.39	8.28	0.32	38.32	0.03	0.04	99.03	8.90	30.31	99.92	61.77	30.07	8.16
96dst102-19i	0.00	52.59	0.31	0.16	2.31	0.20	11.22	0.31	32.13	0.12	0.00	99.36	5.12	27.53	99.88	55.24	40.13	4.63
97dst01-18ilm	0.01	51.80	0.08	0.23	2.76	0.25	10.59	0.25	32.77	0.10	0.03	98.88	5.50	27.82	99.43	56.59	38.38	5.03
97dst06-9ilm	0.01	53.19	0.05	0.21	0.17	0.02	9.76	0.35	34.89	0.01	0.03	98.70	5.28	30.14	99.23	60.40	34.85	4.75
97dst101-15ilm	0.03	51.10	0.08	0.15	3.52	0.26	10.55	0.30	32.87	0.15	0.02	99.02	6.30	27.20	99.65	55.73	38.49	5.78
97dst101-16ilm	0.01	52.22	0.17	0.12	4.97	0.18	12.09	0.37	29.10	0.20	0.00	99.46	4.19	25.33	99.88	51.95	44.19	3.87
97dst101-17ilm	0.03	53.09	0.11	0.26	2.42	0.28	10.77	0.30	32.45	0.16	0.00	99.89	4.18	28.69	100.31	57.65	38.57	3.78
97dst102-21ilm	0.00	51.35	0.12	0.37	2.39	0.28	9.61	0.31	34.23	0.09	0.00	98.73	5.55	29.23	99.29	59.82	35.06	5.12
97dst103-51ilm	0.04	51.33	0.13	0.10	2.10	0.32	9.74	0.33	34.91	0.07	0.02	99.09	6.47	29.09	99.74	58.92	35.17	5.91
97dst103-52ilm	0.00	50.86	0.12	0.19	3.62	0.31	10.64	0.34	32.77	0.16	0.02	99.03	6.56	26.87	99.68	55.10	38.87	6.04
97dst103-53ilm	0.01	52.28	0.26	0.17	2.29	0.29	11.21	0.31	31.94	0.11	0.00	98.86	5.09	27.36	99.37	55.14	40.25	4.61
97dst103-54ilm	0.04	46.70	0.22	0.04	2.84	0.42	7.60	0.32	40.33	0.05	0.00	98.56	12.58	29.01	99.82	60.20	28.08	11.72

Chromite continued

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
00-DST-16-06	0.07	0.20	0.02	16.64	53.46	0.15	13.36	0.33	14.77	0.11	0.04	99.16	0.81	14.05	99.24
00-DST-100-02	0.09	0.23	0.00	17.68	50.70	0.14	14.14	0.27	15.88	0.14	0.06	99.33	3.05	13.14	99.64
00-DST-108-bcde-21	0.10	0.49	0.00	15.07	50.77	0.24	10.66	0.20	22.32	0.04	0.08	99.96	3.87	18.83	100.35
00-DST-108-bcde-22	0.05	0.23	0.00	22.87	46.67	0.16	14.25	0.22	15.49	0.10	0.06	100.10	1.55	14.09	100.26
00-DST-108-bcde-24	0.11	0.36	0.01	15.72	49.24	0.20	8.65	0.31	25.34	0.06	0.06	100.04	3.98	21.76	100.44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.12	[illegible]	[illegible]	[illegible]	100.02
00-DST-110-01	0.10	0.42	0.00	9.14	45.64	0.07	5.03	0.40	37.11	0.09	0.25	98.25	13.03	25.38	99.56
00-DST-200-01	0.05	0.19	0.04	21.73	47.01	0.17	13.43	0.32	16.80	0.14	0.07	99.93	2.02	14.98	100.13
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99.74	[illegible]	[illegible]	[illegible]
00-DST-202-01	0.07	0.43	0.00	14.60	51.66	0.20	10.95	0.21	21.63	0.13	0.05	99.92	3.94	18.08	100.31
00-DST-206-03	0.10	0.23	0.06	21.49	42.12	0.27	9.84	0.52	24.83	0.13	0.11	99.69	4.87	20.45	100.17
00-DST-206-04	0.07	0.13	0.01	19.33	48.56	0.23	12.75	0.23	18.36	0.13	0.07	99.88	2.87	15.77	100.17
00-DST-206-05	0.07	0.32	0.00	14.49	49.56	0.20	10.35	0.43	23.72	0.10	0.10	99.36	5.83	18.48	99.94
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
00-DST-206-07	0.05	0.18	0.00	21.56	46.59	0.15	13.50	0.22	17.59	0.11	0.07	100.01	2.95	14.93	100.31
00-DST-206-12	0.08	0.36	0.00	17.20	49.80	0.12	12.93	0.31	17.91	0.13	0.03	98.86	3.39	14.86	99.20
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
01-DST-04-01	0.09	0.53	0.00	17.16	48.53	0.18	8.14	1.04	23.14	0.09	0.51	99.40	1.89	21.44	99.59
01-DST-04-02	0.08	0.49	0.06	15.85	51.23	0.22	10.70	0.93	19.86	0.10	0.38	99.90	2.32	17.77	100.14
01-DST-04-03	0.09	0.41	0.06	15.56	52.32	0.18	11.89	0.87	17.87	0.09	0.29	99.63	2.24	15.85	99.86
01-DST-04-04	0.08	0.57	0.00	16.64	49.87	0.22	10.49	0.99	20.03	0.10	0.48	99.46	2.32	17.94	99.69

ILMENITE

Mg-rich Ilmenite (kimberlitic affinity, > 4 wt% MgO)

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total	ilmenite	geikilite	hematite
95dst120-7i	0.02	50.87	0.09	0.16	3.11	0.26	10.25	0.29	33.68	0.14	0.02	98.90	6.80	27.56	99.58	56.38	37.36	6.25
95dst24-5i	0.00	51.05	0.15	0.14	3.91	0.29	10.37	0.33	32.69	0.15	0.00	99.08	5.70	27.56	99.65	56.72	38.02	5.27
96dst02-8i	0.01	49.45	0.12	0.07	2.56	0.20	8.56	0.34	37.50	0.09	0.00	98.91	9.17	29.25	99.82	60.14	31.37	8.49
96dst03-45i	0.00	49.63	0.19	0.06	1.77	0.39	8.28	0.32	38.32	0.03	0.04	99.03	8.90	30.31	99.92	61.77	30.07	8.16
96dst102-19i	0.00	52.59	0.31	0.16	2.31	0.20	11.22	0.31	32.13	0.12	0.00	99.36	5.12	27.53	99.88	55.24	40.13	4.63
97dst01-18ilm	0.01	51.80	0.08	0.23	2.76	0.25	10.59	0.25	32.77	0.10	0.03	98.88	5.50	27.82	99.43	56.59	38.38	5.03
97dst06-9ilm	0.01	53.19	0.05	0.21	0.17	0.02	9.76	0.35	34.89	0.01	0.03	98.70	5.28	30.14	99.23	60.40	34.85	4.75
97dst101-15ilm	0.03	51.10	0.08	0.15	3.52	0.26	10.55	0.30	32.87	0.15	0.02	99.02	6.30	27.20	99.65	55.73	38.49	5.78
97dst101-16ilm	0.01	52.22	0.17	0.12	4.97	0.18	12.09	0.37	29.10	0.20	0.00	99.46	4.19	25.33	99.88	51.95	44.19	3.87
97dst101-17ilm	0.03	53.09	0.11	0.26	2.42	0.28	10.77	0.30	32.45	0.16	0.00	99.89	4.18	28.69	100.31	57.65	38.57	3.78
97dst102-21ilm	0.00	51.35	0.12	0.37	2.39	0.28	9.61	0.31	34.23	0.09	0.00	98.73	5.55	29.23	99.29	59.82	35.06	5.12
97dst103-51ilm	0.04	51.33	0.13	0.10	2.10	0.32	9.74	0.33	34.91	0.07	0.02	99.09	6.47	29.09	99.74	58.92	35.17	5.91
97dst103-52ilm	0.00	50.86	0.12	0.19	3.62	0.31	10.64	0.34	32.77	0.16	0.02	99.03	6.56	26.87	99.68	55.10	38.87	6.04
97dst103-53ilm	0.01	52.28	0.26	0.17	2.29	0.29	11.21	0.31	31.94	0.11	0.00	98.86	5.09	27.36	99.37	55.14	40.25	4.61
97dst103-54ilm	0.04	46.70	0.22	0.04	2.84	0.42	7.60	0.32	40.33	0.05	0.00	98.56	12.58	29.01	99.82	60.20	28.08	11.72

Mg-rich Ilmenite (kimberlitic affinity, > 4 wt% MgO)(Continued)

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total	ilmenite	geikilite	hematite
97dst103-55ilm	0.03	52.62	0.09	0.29	2.15	0.25	10.86	0.24	32.71	0.12	0.05	99.42	5.12	28.11	99.93	56.46	38.90	4.64
97dst103-56ilm	0.01	50.16	0.09	0.11	4.02	0.26	10.30	0.34	33.35	0.16	0.00	98.80	7.30	26.78	99.53	55.30	37.91	6.79
97dst105-33ilm	0.01	50.05	0.17	0.04	3.47	0.34	9.85	0.38	34.67	0.09	0.02	99.08	7.75	27.69	99.86	56.83	36.02	7.15
98dst04-4ilm	0.01	52.40	0.00	0.28	2.21	0.31	10.82	0.29	32.46	0.13	0.05	98.96	5.09	27.87	99.47	56.38	38.99	4.63
98dst04-5ilm	0.02	52.51	0.07	0.26	2.17	0.27	10.87	0.28	32.40	0.13	0.04	99.02	4.96	27.94	99.51	56.39	39.10	4.51
98dst04-6ilm	0.02	52.57	0.06	0.25	2.15	0.25	10.88	0.28	32.52	0.12	0.00	99.11	5.03	27.99	99.61	56.35	39.06	4.58
98dst07-7ilm	0.01	45.27	0.16	0.14	1.05	0.61	6.14	0.25	44.81	0.03	0.01	98.48	15.77	30.62	100.06	62.94	22.49	14.58
98dst102-8ilm	0.00	51.99	0.15	0.20	2.52	0.26	10.76	0.27	32.79	0.16	0.02	99.12	5.64	27.71	99.69	56.06	38.80	5.14
98dst102-9ilm	0.02	51.71	0.08	0.25	2.89	0.26	10.94	0.25	31.84	0.10	0.02	98.36	5.20	27.16	98.88	55.43	39.79	4.78
98dst302-10ilm	0.00	51.71	0.01	0.22	2.41	0.29	10.76	0.26	32.98	0.12	0.00	98.75	6.18	27.42	99.37	55.53	38.84	5.63
99-DST-02-01	0.04	49.01	0.07	0.09	4.05	0.35	9.96	0.30	35.30	0.10	0.02	99.28	9.70	26.58	100.25	54.58	36.46	8.96
99-DST-124-02	0.02	50.04	0.13	0.10	4.36	0.28	10.46	0.37	33.57	0.13	0.02	99.49	7.92	26.45	100.28	54.37	38.30	7.33
00-DST-07-06	0.04	51.67	0.13	0.13	2.32	0.28	11.59	0.28	32.75	0.15	0.00	99.31	7.47	26.02	100.06	52.01	41.27	6.72
00-DST-16-07	0.05	52.23	0.12	0.15	2.39	0.21	10.87	0.36	33.29	0.11	0.02	99.80	6.30	27.62	100.43	55.44	38.88	5.69
00-DST-16-08	0.03	50.91	0.12	0.15	3.65	0.31	10.88	0.32	33.23	0.15	0.03	99.77	7.43	26.55	100.51	53.87	39.35	6.78
00-DST-108-bcde-46	0.05	52.08	0.27	0.07	3.74	0.19	11.28	0.34	31.62	0.15	0.01	99.80	5.27	26.88	100.32	54.46	40.74	4.80
00-DST-108-bcde-47	0.07	51.93	0.02	0.16	2.77	0.27	10.79	0.35	33.21	0.13	0.02	99.71	6.36	27.49	100.35	55.45	38.78	5.77
00-DST-108-bcde-49	0.05	50.25	0.11	0.15	3.43	0.21	10.07	0.33	34.38	0.10	0.02	99.09	7.87	27.30	99.88	55.96	36.78	7.26
00-DST-108-bcde-50	0.06	51.26	0.18	0.09	3.54	0.30	10.73	0.38	33.36	0.12	0.03	100.06	6.86	27.19	100.74	55.04	38.71	6.25
00-DST-108-bcde-51	0.06	50.06	0.47	0.11	4.19	0.34	10.37	0.40	33.25	0.12	0.01	99.36	6.81	27.12	100.04	55.73	37.97	6.30
00-DST-108-bcde-52	0.05	53.26	0.08	0.20	2.40	0.20	11.89	0.32	31.53	0.08	0.01	100.00	5.31	26.75	100.53	53.15	42.10	4.75
00-DST-108-bcde-53	0.07	51.54	0.06	0.18	4.50	0.22	11.63	0.37	30.90	0.16	0.01	99.64	5.90	25.59	100.23	52.26	42.32	5.42
00-DST-108-bcde-54	0.01	50.96	0.15	0.12	3.25	0.33	11.41	0.33	32.70	0.12	0.01	99.41	7.74	25.74	100.18	51.95	41.03	7.02
00-DST-108-bcde-55	0.05	51.19	0.05	0.13	3.36	0.24	10.62	0.37	33.85	0.12	0.00	99.97	7.50	27.10	100.72	54.85	38.32	6.83
00-DST-108-bcde-56	0.05	50.75	0.07	0.17	3.61	0.22	10.59	0.29	33.68	0.15	0.00	99.58	7.64	26.80	100.35	54.58	38.42	7.00
00-DST-108-bcde-57	0.04	53.21	0.09	0.39	2.91	0.18	12.59	0.33	29.98	0.17	0.00	99.88	5.15	25.34	100.40	50.60	44.77	4.63
00-DST-108-bcde-58	0.04	51.30	0.08	0.17	3.48	0.32	10.94	0.31	32.84	0.15	0.02	99.63	6.71	26.81	100.31	54.35	39.53	6.12
00-DST-108-bcde-59	0.04	53.30	0.06	0.17	2.19	0.17	11.86	0.31	31.26	0.10	0.00	99.47	5.01	26.75	99.97	53.35	42.16	4.50
00-DST-108-bcde-60	0.05	49.39	0.17	0.10	3.88	0.33	9.66	0.35	35.42	0.10	0.00	99.44	8.79	27.50	100.32	56.50	35.37	8.13
00-DST-108-bcde-61	0.03	50.45	0.09	0.18	3.82	0.26	10.56	0.31	33.52	0.15	0.02	99.39	7.67	26.62	100.16	54.45	38.49	7.06
00-DST-108-bcde-62	0.04	49.16	0.33	0.05	3.08	0.31	9.25	0.41	36.62	0.10	0.01	99.35	9.47	28.10	100.30	57.54	33.74	8.73
00-DST-108-bcde-63	0.03	51.06	0.05	0.31	3.63	0.26	11.12	0.30	32.37	0.17	0.02	99.32	6.97	26.10	100.02	53.20	40.41	6.39
00-DST-108-bcde-64	0.06	50.95	0.21	0.02	3.56	0.25	10.81	0.39	32.98	0.15	0.00	99.38	6.98	26.70	100.08	54.37	39.24	6.39
00-DST-108-bcde-65	0.00	53.39	0.03	0.18	2.34	0.23	11.63	0.36	31.51	0.09	0.03	99.79	4.77	27.22	100.27	54.34	41.38	4.28
00-DST-112-01	0.03	51.47	0.08	0.18	4.59	0.28	11.46	0.34	31.02	0.17	0.01	99.64	5.66	25.93	100.20	53.03	41.76	5.21
00-DST-203-01	0.04	51.44	0.36	0.10	2.67	0.34	10.00	0.38	34.75	0.08	0.00	100.15	6.46	28.94	100.80	58.26	35.89	5.85
00-DST-205A-04	0.03	51.96	0.16	0.19	3.06	0.31	11.11	0.35	32.69	0.13	0.00	99.99	6.16	27.15	100.60	54.61	39.81	5.57
96dst02-10i	0.00	37.66	0.54	0.01	0.01	0.03	0.07	5.84	51.73	0.02	0.18	96.09	26.07	28.27	98.71	70.47	0.31	29.22
96dst02-9i	0.02	49.76	0.86	0.00	0.01	0.00	0.06	7.44	41.12	0.03	0.06	99.36	3.50	37.98	99.72	95.77	0.27	3.96

Mg-poor Ilmenite (<4 wt % MgO)

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total	ilmenite	geikilite	hematite
96dst03-46i	0.03	51.76	0.03	0.02	0.00	0.11	0.13	2.70	45.53	0.02	0.01	100.32	1.93	43.79	100.51	97.55	0.52	1.93
96dst03-47i	0.01	46.83	0.22	0.02	0.00	0.00	0.08	4.69	46.58	0.00	0.09	98.51	10.22	37.39	99.54	88.75	0.34	10.91
96dst102-13i	0.01	52.52	0.00	0.02	0.01	0.00	0.09	1.87	45.64	0.00	0.03	100.17	0.52	45.16	100.22	99.12	0.35	0.53
96dst102-20i	0.03	51.23	0.43	0.00	0.00	0.00	0.04	9.53	38.34	0.03	0.12	99.76	1.81	36.71	99.94	97.64	0.19	2.17
97dst01-17ilm	0.04	48.81	0.46	0.02	0.00	0.00	0.05	3.23	46.22	0.01	0.05	98.90	5.77	41.03	99.48	93.85	0.20	5.94
97dst06-10ilm	0.00	49.69	0.03	0.01	0.04	0.18	0.04	0.23	49.07	0.04	0.00	99.32	4.91	44.66	99.81	95.15	0.15	4.70
97dst06-11ilm	0.01	49.57	0.06	0.01	0.02	0.03	0.02	1.28	49.25	0.00	0.02	100.27	6.59	43.33	100.93	93.56	0.08	6.37
97dst06-12ilm	0.02	47.79	0.03	0.04	0.08	0.32	1.25	0.36	49.43	0.00	0.04	99.33	9.46	40.91	100.28	86.31	4.70	8.99
97dst09-7ilm	0.06	46.50	0.19	0.01	0.01	0.13	1.04	0.38	50.15	0.01	0.01	98.50	11.22	40.05	99.62	85.29	3.95	10.77
97dst09-8ilm	0.04	45.85	0.07	0.03	0.00	0.10	0.11	5.87	46.45	0.03	0.08	98.63	12.41	35.28	99.87	85.91	0.48	13.61
97dst103-41ilm	0.03	51.93	0.18	0.00	0.05	0.20	0.09	0.47	47.03	0.00	0.02	100.00	0.47	46.61	100.04	99.19	0.34	0.47
97dst103-42ilm	0.02	51.02	0.01	0.06	0.01	0.04	1.91	0.75	45.44	0.02	0.00	99.29	4.04	41.80	99.69	88.89	7.24	3.88
97dst103-43ilm	0.00	43.79	0.12	0.03	0.03	0.04	1.54	0.84	50.90	0.04	0.00	97.33	16.65	35.93	98.99	77.85	5.94	16.21
97dst103-44ilm	0.05	50.93	0.04	0.05	0.00	0.04	0.05	1.13	46.94	0.04	0.05	99.33	2.53	44.66	99.58	97.31	0.19	2.50
97dst103-45ilm	0.01	46.99	0.03	0.05	0.02	0.03	0.09	1.53	50.17	0.02	0.03	98.95	10.65	40.59	100.02	89.13	0.35	10.52
97dst103-46ilm	0.00	49.64	0.07	0.02	0.02	0.01	0.11	4.97	44.29	0.00	0.03	99.15	5.32	39.49	99.68	93.81	0.47	5.72
97dst103-47ilm	0.03	49.32	0.04	0.01	0.02	0.06	0.38	3.65	46.41	0.00	0.02	99.95	6.97	40.14	100.65	91.32	1.54	7.14
97dst103-48ilm	0.01	50.36	0.00	0.00	0.00	0.00	0.17	8.73	40.07	0.03	0.05	99.43	4.45	36.07	99.88	94.01	0.79	5.20
97dst103-49ilm	0.00	48.17	0.02	0.02	0.01	0.12	0.09	2.50	48.44	0.03	0.04	99.44	8.51	40.78	100.29	91.08	0.36	8.57
97dst103-50ilm	0.03	46.08	0.13	0.02	0.15	0.17	0.16	0.70	51.41	0.00	0.02	98.88	11.73	40.86	100.05	88.04	0.61	11.35
97dst105-32ilm	0.02	49.92	0.04	0.00	0.00	0.07	0.03	3.30	46.21	0.00	0.00	99.60	5.04	41.68	100.10	94.72	0.12	5.16
98dst02-1ilm	0.00	49.30	0.10	0.04	0.00	0.04	0.39	1.71	47.95	0.00	0.04	99.58	6.57	42.04	100.24	92.01	1.52	6.47
98dst302-11ilm	0.02	51.63	0.00	0.02	0.02	0.00	0.08	2.69	45.22	0.00	0.03	99.70	1.85	43.55	99.89	97.81	0.32	1.87

Crustal Ilmenites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total	ilmenite	geikilite	hematite
99-DST-44-03	0.06	49.86	0.00	0.00	0.03	0.12	0.05	4.34	45.18	0.00	0.02	99.68	5.11	40.58	100.19	94.42	0.22	5.35
99-DST-101-01	0.03	47.81	0.02	0.03	0.01	0.09	0.63	0.88	49.33	0.00	0.02	98.84	9.08	41.16	99.75	88.78	2.41	8.81
01-DST-02-01	0.04	48.87	0.03	0.02	0.04	0.23	0.09	2.02	47.67	0.01	0.02	99.03	6.12	42.16	99.64	93.55	0.34	6.11
01-DST-02-02	0.02	48.57	0.02	0.02	0.02	0.19	0.10	1.85	48.74	0.01	0.02	99.57	7.55	41.94	100.32	92.14	0.39	7.47
01-DST-02-03	0.04	47.15	0.00	0.00	0.04	0.22	0.09	2.05	49.34	0.02	0.00	98.95	9.79	40.53	99.93	89.88	0.36	9.77
01-DST-02-04	0.02	47.44	0.03	0.00	0.02	0.17	0.10	1.85	49.07	0.01	0.00	98.71	9.04	40.93	99.62	90.60	0.39	9.00
01-DST-02-05	0.03	50.24	0.21	0.03	0.00	0.02	0.02	1.92	47.26	0.01	0.00	99.73	4.20	43.48	100.15	95.75	0.08	4.17
01-DST-03-01	0.04	52.74	0.04	0.02	0.01	0.00	0.13	3.65	43.97	0.02	0.00	100.63	0.44	43.58	100.67	99.04	0.51	0.45
01-DST-03-02	0.03	46.95	0.02	0.01	0.01	0.11	0.16	2.93	48.79	0.00	0.00	99.01	10.65	39.20	100.08	88.54	0.64	10.82
01-DST-03-03	0.03	47.75	0.18	0.01	0.03	0.00	0.13	2.79	48.07	0.01	0.00	99.01	8.86	40.10	99.89	90.49	0.51	8.99
01-DST-03-04	0.03	48.07	0.14	0.03	0.06	0.04	0.11	2.95	47.56	0.02	0.02	99.04	8.10	40.26	99.85	91.29	0.44	8.27
01-DST-03-05	0.03	48.35	0.12	0.01	0.10	0.08	0.04	3.30	47.87	0.01	0.02	99.94	8.37	40.33	100.78	91.31	0.16	8.53
01-DST-04-05	0.04	52.77	0.00	0.02	0.02	0.00	0.39	2.56	44.34	0.02	0.01	100.16	0.17	44.18	100.18	98.26	1.56	0.17
01-DST-04-06	0.15	52.09	0.00	0.01	0.04	0.00	0.49	2.35	44.45	0.04	0.02	99.63	0.83	43.71	99.72	97.22	1.95	0.83

Crustal Ilmenites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total	ilmenite	geikilite	hematite
01-DST-04-07	0.14	52.11	0.00	0.00	0.00	0.03	0.53	2.41	44.77	0.04	0.01	100.01	1.25	43.65	100.14	96.68	2.07	1.24
00-DST-206-08	0.02	52.24	0.00	0.03	0.10	0.33	0.34	0.28	46.80	0.01	0.02	100.15	0.20	46.62	100.17	98.55	1.26	0.19

Table 9: Indicator minerals associated with base metal mineralization (after Averill, 2001), regional metamorphic terrains and non-mineralized mafic/ultramafic rocks. Shaded areas indicate mineral species presence.

1	2	3	4	5	6	7
Indicator Mineral	MVMS	Ni-Cu	Skarn	Greisen	Amphibolite to granulite metamorphism	Non mineralized mafic and ultramafic rocks
sillimanite	▨				▨	
kyanite	▨				▨	
corundum	▨				▨	
orthopyroxene	▨	▨			▨	▨
Mg-spinel	▨				▨	
sapphirine	▨				▨	
staurolite	▨				▨	
anthophyllite	▨					
tourmaline	▨			▨		
dumortierite	▨					
Mn-epidote	▨					
spessartine	▨					
gahnite	▨					
franklinite	▨					
willemite	▨					
Cr-rutile	▨	▨				
barite	▨					
chalcopyrite	▨	▨	▨	▨		
cinnibar	▨					
loellingite	▨	▨				
native gold	▨		▨			
hercynite		▨				
olivine		▨				▨
low-Cr diopside		▨				▨
chromite		▨				▨
uvarovite		▨				
rammelsbergite		▨				
sperrylite		▨				
PGE alloys		▨				
forsterite			▨			
knebelite			▨			
vesuvianite			▨			
johannsenite			▨			
grossular			▨			
scheelite			▨			
topaz				▨		
fluorite				▨		
cassiterite				▨		
wolframite				▨		

Table 10: Summary of the shape, roundness and surface texture of kimberlite indicator grains in relation to stages of particle wear.

Stage of particle wear	Shape (Form)	Roundness	Surface Texture
Within Kimberlite	Generally spherical or asymmetric where fractured	Variably angular in the case of preserved crystal faces or fractured grains to rounded depending on amount of resorption	Variable from rare smooth crystal faces to pitted, matte, fractured and colloform surfaces on resorbed or coated grains. Fracture surfaces may show alteration or coating
Weathering	Spherical, skeletal, bladed to irregular	Overall outline is rounded	Pitted, etched, fibrous, rough or exfoliated
Pre-glacial wear (aqueous or eolian)	Spherical	Sub-rounded to rounded depending on amount of wear	Mico-cracked, frosted, chipped
Sub-glacial	Spherical, disc, blade and asymmetric	Angular to sub-angular	Fresh conchoidal breaks, irregular microtopography, striated, chipped, plucked and showing wear facets
Englacial (high level)	No change in shape	No change in roundness	No change in surface texture
Fluvial (glaciofluvial and modern river)	Spherical	Sub-rounded to rounded	V-shaped percussion marks, chipped, microfractured
Lacustrine (glaciolacustrine and modern beach)	Spherical	Sub-rounded to rounded	Micro-cracked, frosted, chipped

Table 11: Chromite grain descriptions and inferred environment. Samples from east of the Sachigo moraine are in normal text, samples from west of the Sachigo moraine are in italics.

Sample	Medium	Description	Interpretation
99DST36 (1)	Till	An angular fragment with fresh conchoidal breaks and rough micro-topography; possibly some remnant crystal faces	Subglacial crushing
99DST37 (1)	Weathered till	A spherical, sub-rounded, chipped grain showing original crystal form, strongly pitted and rough surface	Subglacial chipping and chemical attack
99DST39 (1)	Till	Angular blade, fresh conchoidal breaks, irregular topography	Subglacial crushing
99DST39 (2)	Till	Spherical, sub-angular, possibly striated with irregular topography and chipped, blunted edges	Subglacial crushing, chipping and traction and possibly some grinding that alludes to fluvial activity
00DST100 (1)	Till	Sub-angular, tapered platy grain fragment with fresh conchoidal breaks and irregular topography	Subglacial crushing and chipping
00DST100 (2)	Till	Angular tapered platy grain fragment, fresh conchoidal breaks, chips and irregular topography	Subglacial crushing and chipping
00DST200	Till	Spherical, sub-angular grain with fresh conchoidal breaks and rough topography	Subglacial crushing and chipping
00DST201	Drumlin	Spherical, sub-rounded locally polished grain with some original crystal faces shows old conchoidal chips, circular pits and orange peel texture	The orange peel texture and pits may be resorption features from the kimberlite phase followed by chipping at a subglacial stage. The polish may be due to ice or water; ice is favoured since the polish seems to be only on one side.
00DST202	Till	Spherical sub-rounded grain with flat surfaces probably representing crystal faces, rough pitted surface with early conchoidal breaks	Subglacial crushing followed by weathering
00DST206 (1)	Beach	Spherical, sub-rounded grain with smooth wavy surfaces and chipped blunted edges	Subglacial crushing with possible exfoliation due to weathering followed by chipping and grinding at an aqueous stage
00DST206 (2)	Beach	A spherical, sub-rounded grain showing some crystal faces, local conchoidal breaks and rough topography with rounded blunted edges	Subglacial crushing followed by chipping and grinding of edges at an aqueous stage
00DST206 (3)	Beach	Spherical, sub-angular grain with conchoidal breaks and rough topography, chipped, blunted edges	Subglacial crushing followed by chipping and grinding at an aqueous stage
00DST206 (4)	Beach	Spherical, sub-angular grain with some original crystal faces, local conchoidal breaks and rough topography and chipped edges	Subglacial crushing followed by chipping
00DST206 (5)	Beach	Spherical sub-rounded grain, possibly some original crystal faces, conchoidal breaks, rough topography, chipped blunted edges	Subglacial crushing followed by chipping of edges

00DST07 (1)	Beach	Spherical to platy well-rounded grain with remnants of crystal faces, rough pitted surface	Resorption in kimberlite and/or prolonged chipping, cracking and grinding at an aqueous stage
00DST07 (2)	Beach	Sub-angular blade with remnant crystal faces, conchoidal breaks and local rough topography, chipped edges	Subglacial crushing followed by chipping and possibly grinding at an aqueous stage
00DST07 (3)	Beach	Spherical sub-rounded grain with local polish and local conchoidal breaks, chipped edges	Subglacial crushing followed by chipping and possibly grinding. Part of the grain is smooth polished and well rounded like grain 1 and may indicate wear by aqueous grinding prior to the glacial stage
00DST07 (4)	Beach	Spherical sub-angular grain with conchoidal breaks, rough topography and blunted chipped edges	Subglacial crushing followed by chipping and possibly grinding
00DST08 (1)	Beach	Spherical sub-rounded grain showing remnant crystal faces, early curved breaks and chips, rough surface with pits and some flakes	Early subglacial crushing followed by aqueous impacting, chipping and probably weathering
00DST08 (2)	Beach	Spherical well rounded grain with rough pitted surface split by a conchoidal fracture with chipped edges	Possibly a grain like 00DST07 (1) with prolonged kimberlitic and/or aqueous wear followed by subglacial splitting and late stage chipping and grinding
99DST101 (1)	Sand on bedrock	Rounded triangular blade with remnant crystal faces, old conchoidal breaks, straight and polygonal cracks and extensively chipped and ground edges	Early subglacial crushing followed by chipping and grinding at an aqueous stage and possibly some weathering
99DST101 (2)	Sand on bedrock	Spherical angular grain with remnants of an early rounded smooth surface, extensive conchoidal broken surfaces and minor chipped edges	Possibly prolonged aqueous wear followed by subglacial crushing and minor chipping
00DST210 *(1)*	Till	Tapered sub-angular fragment showing conchoidal breaks and rough texture and moderate chipping and pitting of edges	Subglacial crushing followed by intense chipping and pitting possibly in active stream and/or second glacial deformation event
00DST211 *(1)*	Till	Spherical sub-rounded grain with conchoidal breaks and rough topography with chipped and locally pitted edges	Subglacial crushing followed by chipping and pitting
99DST44 *(1)*	Till	Well preserved crystal form with early conchoidal breaks followed by rounding chipping, pitting and cracking of edges	Subglacial crushing and flaking followed by impacting and grinding
99DST44 *(2)*	Till	Spherical, sub-rounded grain with early conchoidal breaks and rounded, chipped edges, possibly striated	Subglacial crushing followed by chipping
99DST42 *(1)*	Lacustrine silt with sand	Spherical sub-rounded grain with conchoidal breaks, curved, possibly exfoliation cracks and chipped, blunted edges	Subglacial crushing, chipping, and impacting at an aqueous stage and possible weathering
99DST42 *(2)*	Lacustrine silt with sand	Spherical sub-rounded grain with conchoidal breaks, rough topography and possible striations and	Subglacial crushing and possible traction followed by aqueous chipping, impacting and grinding

		extensively chipped and pitted edges	
00DST110 (1)	Gravel	Spherical rounded grain with old conchoidal breaks and extensive chipping, pitting an d rubbing of edges	Subglacial crushing followed by extensive aqueous wear
00DST16 (1)	River sand	Spherical, sub-angular fragment with conchoidal breaks, rough topography and chipped edges	Subglacial crushing with aqueous chipping
00DST16 (2)	River sand	Spherical, sub-rounded grain with preserved crystal outline, early conchoidal breaks followed by extensive chipping, pitting and rubbing of edges	Minor subglacial crushing followed by aqueous wear and possible weathering
00DST16 (3)	River sand	Well preserved crystal outline with chipped and pitted edges and surfaces	Aqueous wear and possible weathering
00DST16 (4)	River sand	Tapered angular slab with conchoidal breaks and minor chipped edges and a possible cracked original crystal face	Subglacial crushing and minor chipping
00DST16 (5)	River sand	Well preserved crystal outline with minor early conchoidal breaks and extensively chipped, cracked and pitted edges	Minor subglacial crushing followed by aqueous wear
00DST16 (6)	River sand	Tapered angular fragment with conchoidal breaks, rough topography and chipped and flaked edges	Subglacial crushing and minor chipping
00DST108 (1)	Beach on drumlin	Spherical sub-rounded grain with conchoidal breaks, rough topography and chipped and pitted edges	Subglacial crushing followed by aqueous wear
00DST108 (2)	Beach on drumlin	Spherical sub-rounded grain with preserved crystal faces, early conchoidal breaks and extensively chipped, cracked and pitted edges	Minor subglacial crushing followed by vigorous impacting and chipping in water and/or a second glacial deformation event
00DST108 (3)	Beach on drumlin	Well preserved crystal outline with chipped, flaked and pitted surfaces	Aqueous wear and possibly weathering
00DST108 (4)	Beach on drumlin	Spherical sub-rounded fragment with early conchoidal breaks and extensively pitted and chipped edges	Subglacial crushing followed by aqueous wear
00DST108 (5)	Beach on drumlin	Well preserved crystal outline with chipped, pitted and cracked edges	Aqueous wear and possible weathering

Table 12: List of samples with chromite of possibly kimberlitic origin.

High Cr and Mg	High Cr and Ti	High Ni and low Zn
96DST01-21c		
		96DST03-33
96DST03-35c		
96DST03-37	96DST03-37	
		96DST03-38
	96DST03-42	96DST03-42
		97DST105-34
97DST108-19		97DST108-19
98DST02-cr1		
		98DST04-cr2
		98DST302-13
98DST102-cr3		
99DST36-40		
		99DST37-41
99DST44-43	99DST44-43	99DST44-43
		99DST101-cr2
		00DST07-48
00DST16-05		00DST16-53
00DST108-58		
00DST201-01		00DST201-01
00DST206-06		
	00DST210-01	

Metric Conversion Table

Conversion from SI to Imperial			**Conversion from Imperial to SI**		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
		AREA			
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
		VOLUME			
1 cm^3	0.061 023	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.307 951	cubic yards	1 cubic yard	0.764 554 86	m^3
		CAPACITY			
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
		MASS			
1 g	0.035 273 962	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 747	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 622 6	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311 3	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 90**	t
		CONCENTRATION			
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

	Multiplied by	
1 ounce (troy) per ton (short)	31.103 477	grams per ton (short)
1 gram per ton (short)	0.032 151	ounces (troy) per ton (short)
1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.